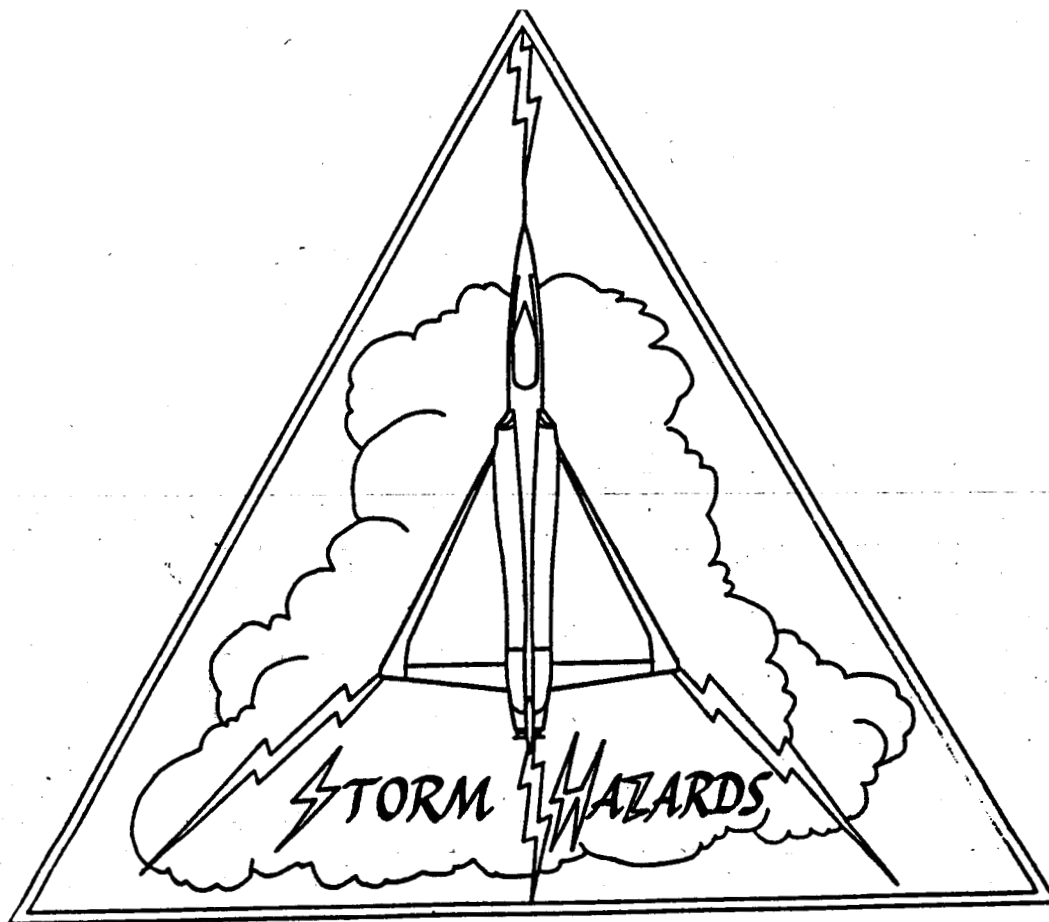


STORM HAZARDS '84  
OPERATIONS SUMMARY

(NASA-CR-182846) STORM HAZARDS 1984  
OPERATIONS SUMMARY (NASA) 376 p

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GSFC/MALLOPS

#141474

STORM HAZARDS '84

OPERATIONS SUMMARY

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APPROVED BY: Bruce D. Fisher  
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Langley Research Center  
Hampton, Virginia  
23665

Reply to Attn of 247

TO: 247/Head, Special Projects Office, LSAD  
FROM: 247/Mathematics Technician, Special Projects Office, LSAD  
SUBJECT: Summary of Storm Hazards '84 Flights

Forty-two flights were made by the F-106B airplane during the Storm Hazards '84 Program. The summary shown in Table I lists 38 as thunderstorm research flights with ground-based measurements from Wallops Flight Facility. During these flights, 247 lightning strikes and 11 nearby flashes were recorded. A detailed summary of the data sets taken on each flight is shown in Table II. The abbreviations used are listed in Table III. Tables I - III are included as enclosure 1.

The physical configuration of the aircraft data systems are shown in figures 1-3. The locations of the data systems are shown in figure 1. Figure 2 shows the external probes and antennas and figure 3 shows the cockpit arrangement. Figures 1-3 are included as enclosure 2.

A list of modifications made to the basic aircraft systems and research systems between 1983 and 1984 is included as enclosure 3.

Enclosure 5 includes the voice transcripts, experimental summary, and the aircraft squawk sheet (where appropriate) for each of the flights.

The Boeing Data Logger system was not installed on the airplane for the '84 storm program.

The onboard lightning photography system flown in 1984 consisted of the following components:

1. Externally-mounted, aft-facing 16-mm color movie camera (figure 1(a)).
2. Aft-facing black and white video camera mounted in the cockpit so as to view both wing tips (figure 1(a)).
3. Video tape recorder mounted in the weapons bay (figure 1(c)).

4. Pair of light-sensing diodes mounted behind the pilot's rear-view mirror so as to view the nose boom.

5. Cockpit-mounted, stereo pair of 70-mm Hasselblad cameras facing forward (figure 1(a)).

6. Single 70-mm Hasselblad camera mounted in the cockpit and facing aft so as to view both wing tips (figure 1(a)).

The external, 16-mm movie camera was flown for the entire season and recorded 70 strikes. On several flights, the camera was modified to trigger automatically for one second bursts following commands from the light-sensing diodes. The automatic frame rate was preset prior to flight at either 200 or 400 frames/second. Details can be found in the experimental summary sheets for each flight. Prior to modification to the automatic mode, the camera was run continuously from a cockpit-mounted switch at a frame rate of 16 frames/second.

The video camera and recorder were installed starting with Flight 84-028, and constituted a highly successful experiment, recording 133 strikes.

The three Hasselblad cameras were installed for Flight 84-052, only. The cameras were triggered simultaneously via inputs from the light-sensing diodes. Unfortunately, the left-side camera in the stereo pair was inoperative during the one strike detected by the diodes. However, the right-side camera and the aft camera both successfully photographed the strike (13:01:54.5 GMT on Flight 84-052).

The NASA-Marshall Knollenberg probe was not installed for the '84 storm season.

The Lightning Technologies Incorporated passive protection system, made up of diverter strips and wire mesh, were flown on all flights. Buttons from the top diverter strip were missing after Flight 84-024 and again following Flight 84-025. The complete strip was gone after Flight 84-026, lightning attachment points were found on the strip after Flight 84-027 and the strip was nicked during Flight 84-028.

Historical Notes 1984, a brief history of the '84 Storm Hazards Season is included as Enclosure 4.

*Merle S. Ott*

Merle S. Ott  
3274

Enclosures as noted.



Letter to 247/Head, Special Projects Office, subject: Summary of  
Hazards '84 Flights

CC:  
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WFF - U-70/G. T. Bishop, IV  
E-107/R. E. Carr  
E-107/J. C. Gerlach  
D-1/B. L. Shaw

246A/LSAD  
247/SPO  
255/Flight Service Office  
257/W. I. Barden, Jr.  
255A/P. W. Brown  
255A/P. L. Deal  
247/R. E. Dunham, Jr.  
247/B. D. Fisher  
497/W. E. Howell  
255/M. A. Klebitz  
247/W. D. Mace, Jr.  
255A/W. R. Neely, Jr.  
255A/J. M. Patton, Jr.  
130/F. L. Pitts  
130/M. E. Thomas  
247/J. W. Usry  
247/R. M. Winebarger  
130/K. P. Zaepfel  
247/M. S. Ott

Table I.- Brief Summary of Storm Hazards '84 Flights.

Storm	Training & Calibration	Strikes	Nearbys
38	4	247	11

Enclosure 1

Table 11.- Summary of Storm Hazards '84 Data Sets.

Flight No.	Date 1984	Crew Pilot/ Obs.	Mission Type	Takeoff Time GMT	Landing Time GMT	No. of Pens.	No. of Strikes	No. of Nearby	LEGROY CHANNELS												Digital Peak Counters	Aft Movie Camera*	Cockpit Camera/ Aft Video*	Field Mills	X-Ray	LOS
									1	2	3	1	2	3	1	2	3	1	2	3						
011	5-17	PMB/-	FAM/ECF	17:31:--	18:37:--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NI	NU/NI						
012	5-18	WRN/BDF	ICF	14:11:30	15:25:39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NI	TBD/NI							
013	5-23	WRN/RHM	Storm	18:05:15	19:36:14	6	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
014	5-27	PMB/BDE	Storm	16:18:44	17:46:16	10	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
015	5-27	PMB/BDF	Storm	20:11:36	21:27:46	9	6	2	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
016	5-28	WRN/RHM	Storm	16:42:08	17:38:03	6	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
017	5-28	WRN/RHM	Storm	19:57:03	21:27:41	14	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
018	5-29	PMB/BDE	Storm	20:01:30	20:58:08	9	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
019	6-5	WRN/RHM	Storm	20:57:32	22:25:42	10	10	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
020	6-6	PMB/BDF	Storm	19:14:39	20:50:04	13	7	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
021	6-7	PMB/VR	Storm	19:53:23	21:31:13	14	3	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
022	6-11	WRN/VR	FAM	15:29:20	17:30:00	0	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
023	6-11	PMB/RHM	Storm	19:43:53	21:29:34	9	3	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
024	6-13	WRN/VR	Storm	18:30:00	20:04:00	15	7	3	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
025	6-13	PMB/BDF	Storm	18:55:53	20:46:53	9	19	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
026	6-14	WRN/RHM	Storm	18:13:06	19:32:38	7	5	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
027	6-14	PMB/RHM	Storm	21:07:10	22:05:04	6	5	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
028	6-28	PMB/BDF	Storm	16:36:25	17:56:55	8	6	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
029	6-29	PMB/RHM	Storm	20:09:14	21:30:44	13	3	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
030	7-2	WRN/BDF	Storm	18:03:26	19:25:53	10	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
031	7-7	WRN/RHM	Storm	15:41:04	17:18:06	12	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
032	7-7	WRN/RHM	Storm	18:45:08	20:02:37	9	5	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
033	7-10	WRN/VR	Storm	20:59:30	22:18:17	5	14	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
034	7-11	PMB/RHM	FAM/ECF	17:31:28	18:47:15	0	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
035	7-16	PMB/BDE	Storm	18:24:40	19:35:47	13	7	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
036	7-24	PMB/RHM	Storm	20:10:15	21:49:02	20	9	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
037	7-25	PMB/VR	Storm	19:02:47	20:28:20	5	72	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
038	7-27	PMB/BDE	Storm	20:11:40	21:44:17	13	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
039	7-28	PMB/BDF	Storm	19:45:09	20:40:19	4	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
040	8-1	WRN/RHM	Storm	20:33:37	21:15:00	3	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
041	8-2	WRN/BDF	Storm	21:27:34	22:55:06	14	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
042	8-3	PMB/RHM	Storm	18:41:33	20:19:20	12	0	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
043	8-8	PMB/BDE	Storm	20:19:19	21:58:08	19	6	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
044	8-9	PMB/RHM	Storm	18:28:36	19:50:12	13	6	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
045	8-9	PMB/RHM	Storm	21:19:29	23:00:05	13	3	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
046	8-12	PMB/RHM	Storm	18:25:56	20:02:08	16	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
047	8-13	PMB/BDF	Storm	19:21:43	20:49:50	13	5	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
048	8-14	PMB/RHM	Storm	18:50:50	20:25:17	18	5	1	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
049	8-23	WRN/VR	Storm	18:59:53	20:06:10	6	1	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
050	8-30	WRN/BDF	Storm	22:04:20	23:33:07	9	27	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
051	9-13	PMB/RHM	Storm	17:54:46	19:26:00	14	1	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							
052	10-18	PMB/RHM	Storm	12:23:41	14:16:57	9	2	0	0	0	0	0	0	0	0	0	0	NI	TBD/NI							

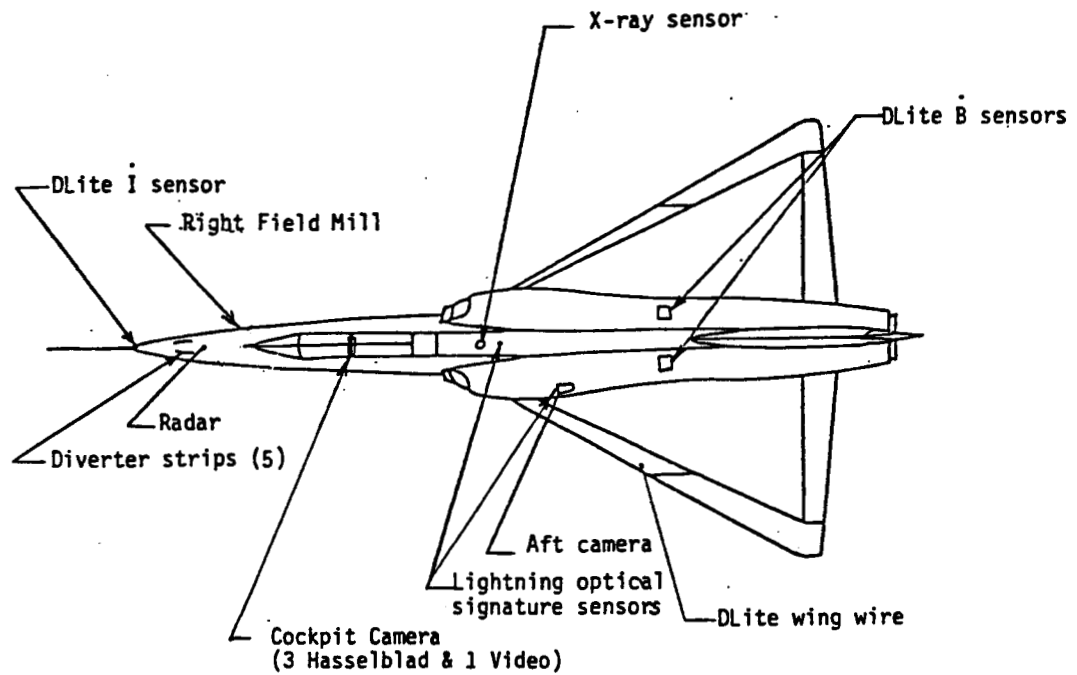
\* Number of strikes recorded.

Table II.- Concluded.

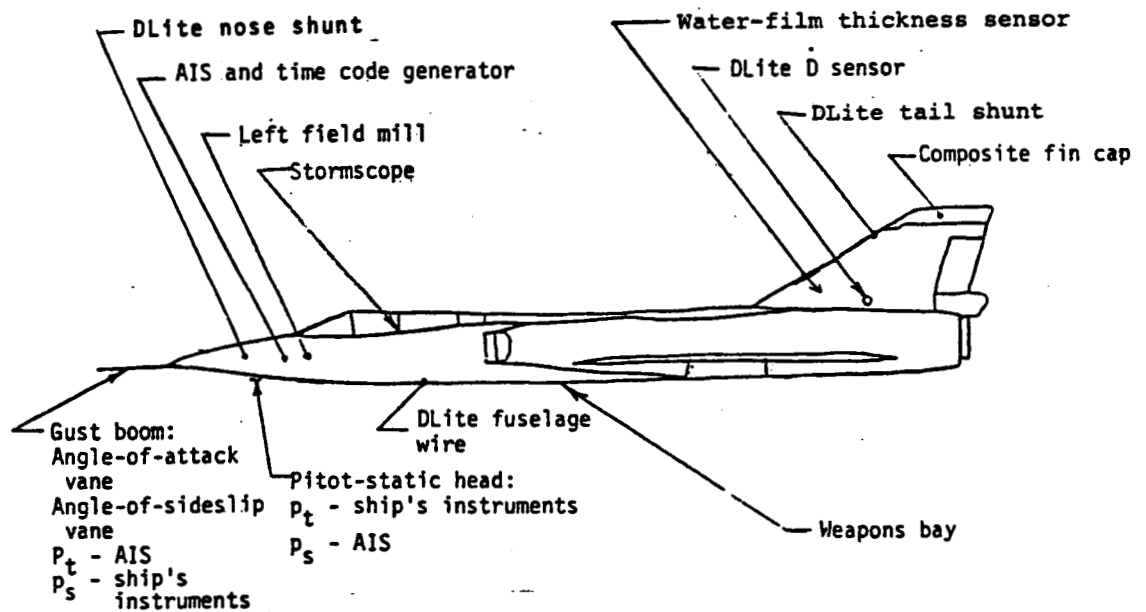
Flight No.	Fin Cap Type	Storm- Scope Aff/0-5	AIS/JUS	Tele- metry Inp/Batt	Airborne Radars			C-Band Beacon	Airborne Radar Video	F-106B Voice Tape	Kavours Radar Up/Link OK/OK	WAL Tele- metry	SPANDAR WDO/dbz	LDAR	UIF Radar	C-Band Tracking	Goddard Antenna GSFC/WFF	LLP
					End	Aft	0-5											
011	KT/EP	NA	NU/X	X/X	X	NU	NU	NU	NU	NU	X/X	X	NU	NU	NU	NU	NU	NU
012	KT/EP	NA	X/X	X/X	X	X	X	X	X	X	X/X	X	NU	NU	INOP	X	NU	NU
013	KT/EP	X/X	X/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	INOP	X	NU/NU	PINOP
014	KT/EP	X/X	X/X	X/X	X	X	X	X	X	X	NU/X	X	NU/X	NU	INOP	X	NU/NU	X
015	KT/EP	X/X	X/X	X/X	X	X	X	X	INOP	X	NU/X	X	X/X	NU	INOP	X	NU/NU	X
016	KT/EP	X/X	INOP	INOP/X	X	X	X	X	X	X	X/X	INOP	X/X	INOP	INOP	X	NU/X	X
017	KT/EP	X/X	X/X	INOP/X	X	X	X	X	X	X	X/X	INOP	X/X	INOP	INOP	X	NU/X	X
018	KT/EP	X/X	X/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	INOP	X	NU/X	X
019	KT/EP	X/X	PP/X	NU/X	X	X	X	X	X	X	X/X	X	NU/PP	NU	X	NU/NU	X	X
020	KT/EP	X/X	X/X	X/X	X	X	X	X	PINOP	X	X/X	X	X/X	INOP	X	NU/NU	X	X
021	KT/EP	X/X	PP/X	X/X	X	X	X	X	NU	NU	NU/X	X	X/X	INOP	X	NU/NU	X	X
022	KT/EP	NA	X/X	X/X	X	X	X	X	X	X	NU/X	X	NU	NU	NU	NU/NU	NU	NU
023	KT/EP	X/X	X/X	X/X	X	X	X	X	X	X	X/X	X	NU/X	NU	X	NU/NU	X	X
024	KT/EP	X/X	X/X	X/X	X	X	X	X	X	X	NU/X	X	X/X	INOP	X	NU/X	X	X
025	KT/EP	INOP	PP/X	X/X	X	X	X	X	X	X	X/X	X	NU/X	NU	X	NU/NU	X	X
026	KT/EP	NI/NI	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	X	NU/NU	X	X
027	KT/EP	NI/NI	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/INOP	INOP	X	NU/X	X	X
028	KT/EP	INOP	X/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	X	NU/X	PINOP	PINOP
029	KT/EP	INOP	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/PP	INOP	X	NU/NU	X	X
030	KT/EP	INOP	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	NU	X	NU/X	X	X
031	KT/EP	INOP	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	X	X	NU/X	X	X
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034	KT/EP	INOP	X/X	X/X	X	X	X	X	X	X	NU/X	X	NU/NU	NU	NU	NU/NU	NU	NU
035	KT/EP	INOP	PP/X	X/X	X	X	X	X	X	X	NU/X	X	X/X	PINOP	X	NU/X	X	X
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037	KT/EP	NU/NU	PP/X	X/X	X	X	X	X	X	X	X/X	X	NU/NU	NU	NU	NU/NU	PINOP	PINOP
038	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	NU/X	X	X/X	INOP	NG	NU/NU	PINOP	PINOP
039	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	NG/NG	INOP	NG	NU/NU	PINOP	PINOP
040	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	X	NU/X	PINOP	PINOP
041	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	X	X	NU/X	PINOP	PINOP
042	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	X	X	NU/NU	PINOP	PINOP
043	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	NU/X	X	X/X	PINOP	X	NU/X	X	X
044	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/INOP	X	X	NU/X	X	X
045	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/INOP	X	X	NU/X	X	X
046	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	NU/X	X	X/X	X	X	NU/X	X	X
047	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	X	X	NU/X	X	X
048	KT/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	X	X	NU/X	X	X
049	G/EP	X/X	PP/X	X/X	X	X	X	X	X	X	NI/X	X	X/X	PINOP	X	NU/X	X	X
050	G/EP	X/X	PP/X	X/X	X	X	X	X	X	INOP	X/X	X	INOP	NU	X	NU/NU	X	X
051	G/EP	X/X	PP/X	X/X	X	X	X	X	X	X	X/X	X	X/X	INOP	X	NU/NU	X	X
052	G/EP	X/X	X/X	X/X	X	X	X	X	X	X	X/X	X	NU/NU	NU	NU	NU/NU	X	X

Table III.- Abbreviations Used in Tables and Enclosures

ACEE	Aircraft Energy Efficiency Program
AIS	Aircraft Instrumentation System
Fam	Familiarization Flight
FCF	Functional Check Flight
G/EP	Graphite Epoxy
GMT	Greenwich Mean Time
ICF	Instrument Check Flight
INOP or IP	Inoperative
INS	Inertial Guidance System
KT/EP	Kevlar Thorstrand Epoxy
LaRC	Langley Research Center
LDAR	Lightning Detection and Ranging System
LFI	Langley Air Force Base (LaRC)
LLP	Lightning Location and Protection System
LOS	Lightning Optical Sensor
NA	Not Applicable
NG	No Good
NI	Not Installed
NU	Not Used
NWS	National Weather Service
PINOP or PP	Partially Inoperative
TM	Telemeter
VDO	Video
WAL	Wallops Flight Center
X	Data Available

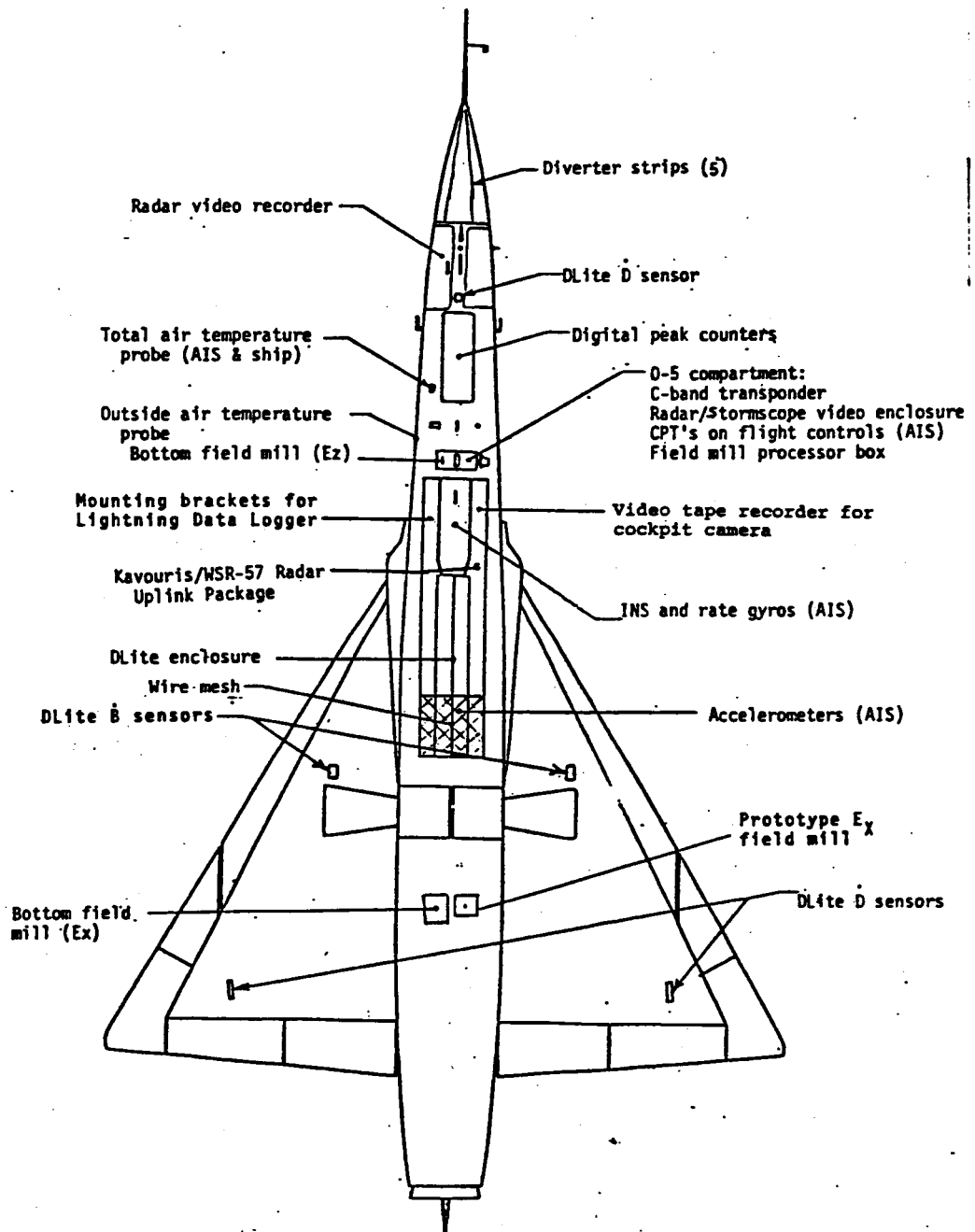


(a) Top view



(b) Side view

Figure 1.- Location of research data systems on NASA F-106B aircraft for Storm Hazards '84 program.



(c) Bottom view

Figure 1.- Concluded.



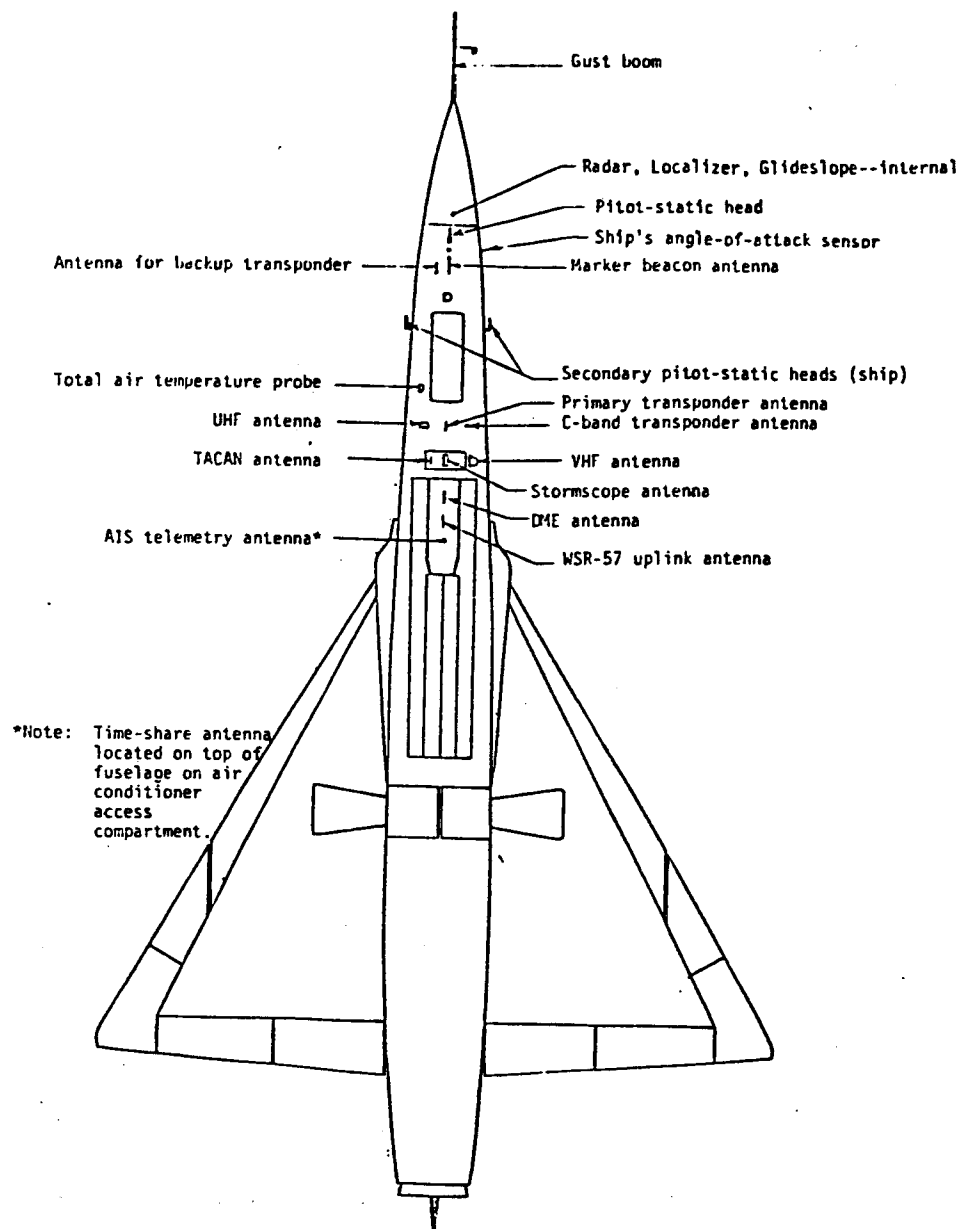
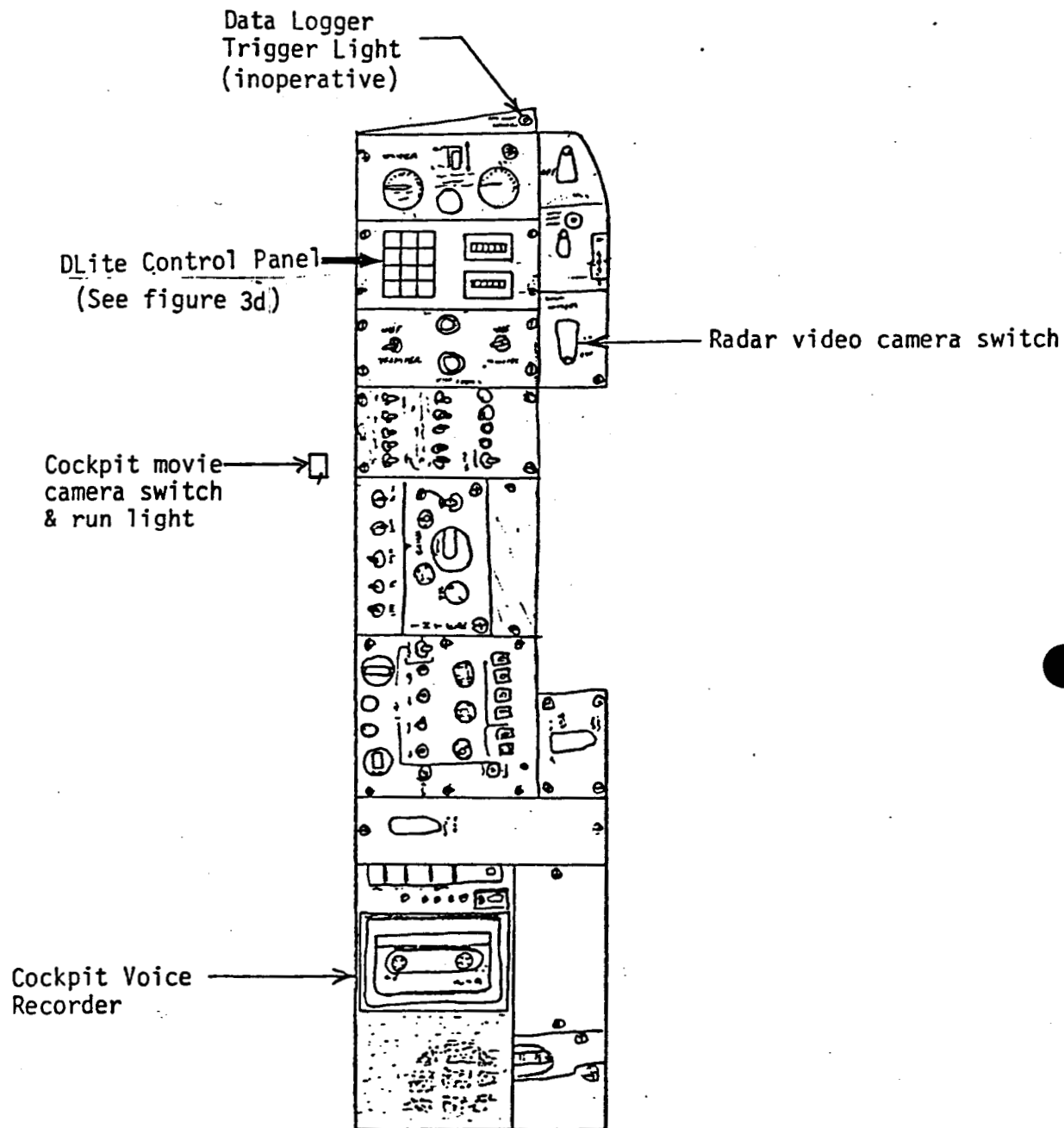
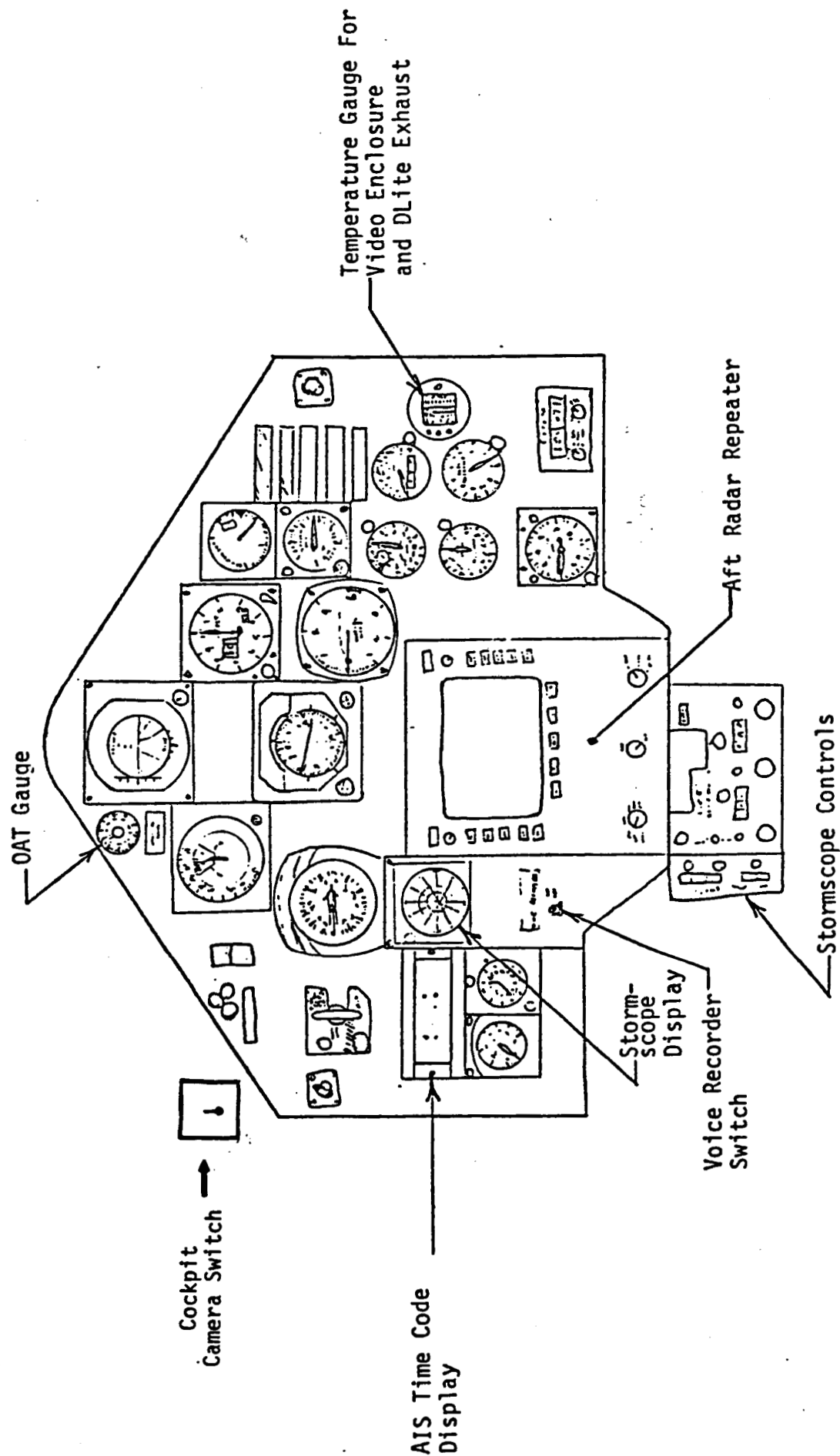


Figure 2.- External probes and antennas on F-106B aircraft for Storm Hazards '84 Program. Bottom view



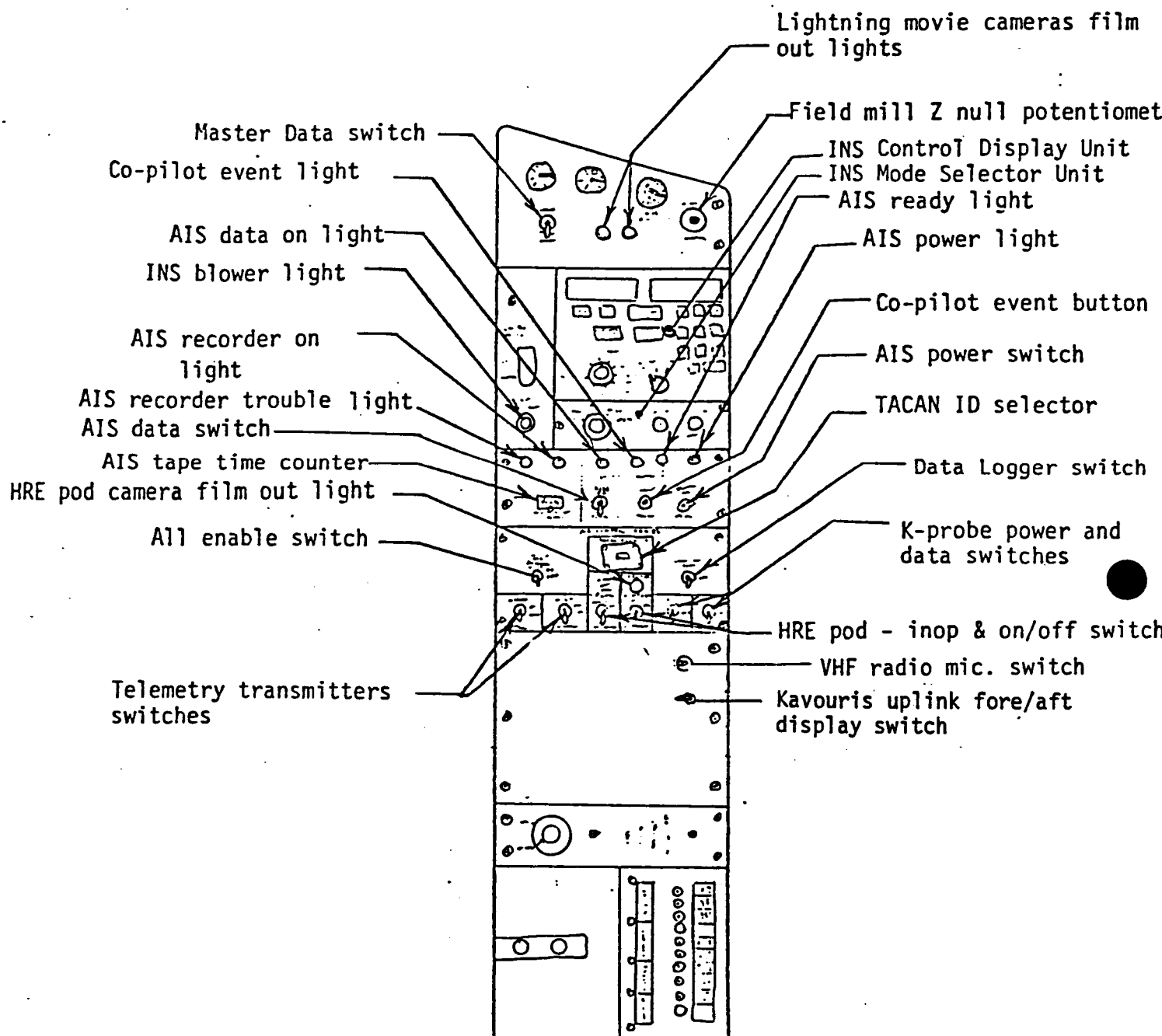
(a) Left side console

Figure 3.- Instrument consoles in aft cockpit during Storm Hazards '84 Program.



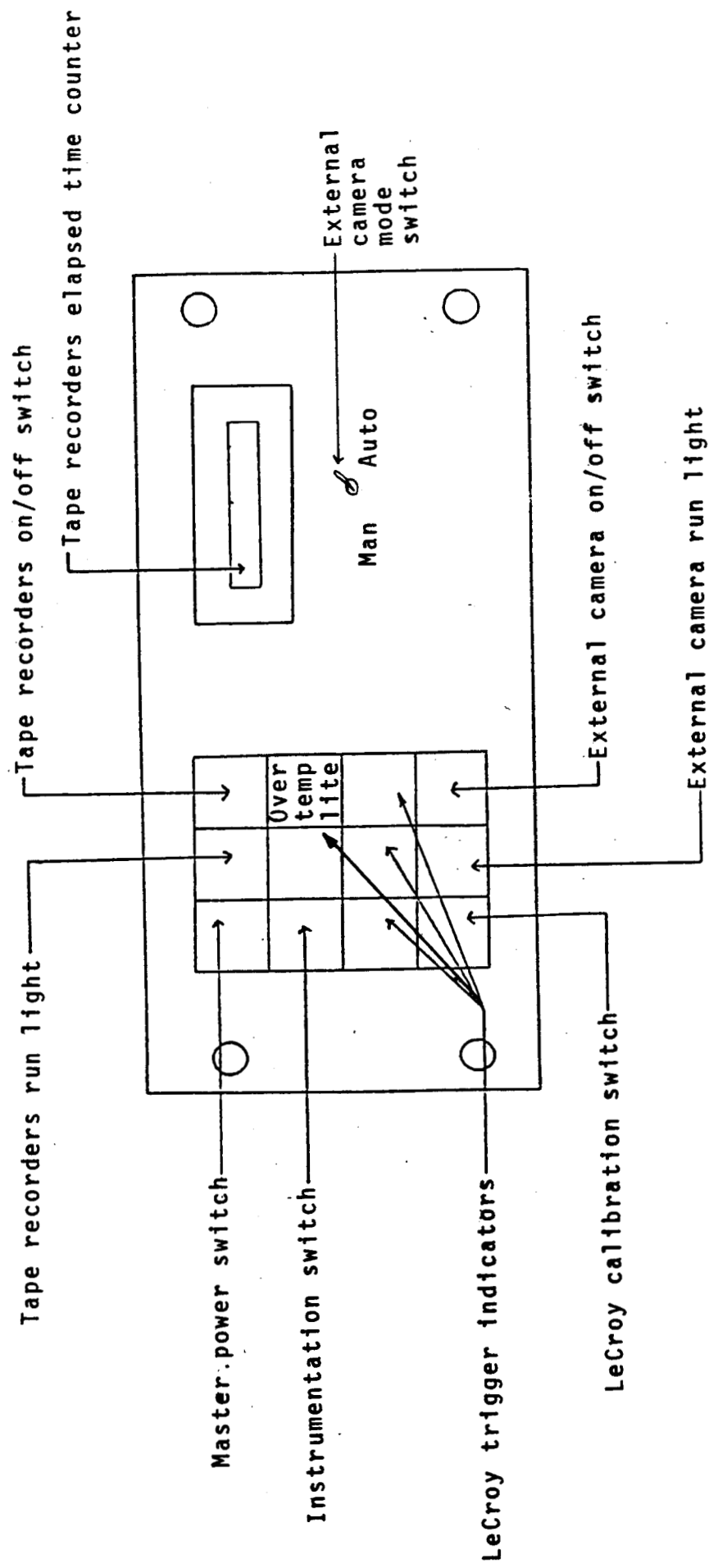
(b) Forward console

Figure 3.- Continued.



(c) Right side console

Figure 3.- Continued.



(d) Dlite control panel

Figure 3.- Concluded.

## MODIFICATIONS TO F-106B FOR STORM HAZARDS '84

### Basic Aircraft Systems

#### Mechanical Systems

1. Performed radar/radome/diverter strip compatibility checks.
2. Installed new radome with five full-length segmented diverter strips for enhanced lightning protection. Radome and strips repaired several times.
3. Installed stainless steel leading edges for variramps to reduce rain damage.
4. Painted "Langley Research Center" on each side of fuselage.

#### Aircraft Avionics

1. Sealed wave guide to X-band radar to prevent moisture intrusion.
2. Installed two sensors to monitor internal responses of X-band radar to lightning. Not recorded.
3. Installed varistors in canopy heater circuits.

### Research Systems

#### DLite

1. Increased number of LeCroy channels from 3 to 12 with up to 3 at 5 ns sample rate.
2. Added ram-air cooling for DLite.
3. Modified DLite enclosure and internal configuration to provide enhanced cooling.
4. Replaced current transformers in radome with shunt to measure lightning current in nose boom.
5. Installed AFWL sensors on specially installed dummy and avionics wiring to monitor induced currents and voltages.
6. Installed weapons bay cooling door assembly in left wing root and associated ducting from door to bay. Used to provide cooling to DLite at AFWL and during preflights.

#### Data Logger

1. Removed Data Loggers.

#### Field Mills

1. Installed prototype E<sub>x</sub> field mill.

#### Lightning Cameras

1. Installed cockpit video camera and recorder.

2. Upgraded external 16-mm movie camera by adding lens, heated glass, modified shroud, and automatic actuation @ 200 or 400 pps by diodes.
3. Installed system of three Hasselblad cameras in cockpit - stereo pair forward and single camera aft. All three actuated by light-sensing diodes.

#### AIS/INS/Telemetry/C-Band Transponder

1. Removed balsa wood flow vanes. Tested "supervanes," balsa wood with external fiberglass sheath.
2. Modified AIS to record and telemeter fuel weight.
3. Evaluated 3-M abrasion resistant film on 2 telemetry antenna covers. Film did not provide improved erosion wear, and no further covers were modified.
4. Replaced telemetry antenna covers with new units with improved mount rings.

#### Composite Fin Cap

1. Used both KT/EP and G/EP fin caps.
2. Added sacrificial "pencil" to tip of G/EP fin cap to reduce lightning damage.

#### NWS Radar Uplink

1. Modified Kavouris uplink system to allow pilot and flight test engineer to view Kavouris uplink or airborne display independently.

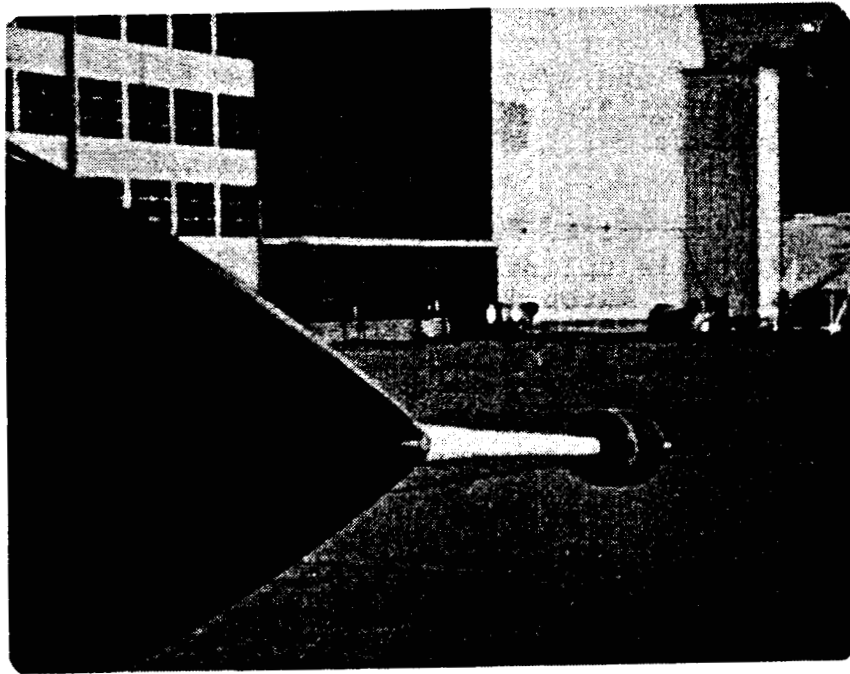
#### Miscellaneous

1. Installed upgraded X-ray sensor which had simultaneous active and passive output.
2. Removed ACEE charge patch from leading edge of vertical tail. Experiment complete.
3. Installed water film thickness sensor on vertical tail.
4. Installed new LOS sensor adjacent to external 16-mm movie camera.

## HISTORICAL NOTES 1984

### 1. Simulated Nuclear Electromagnetic Pulse (SNEMP) Testing.

In February - March 1984, the aircraft and an extensive support crew were engaged in Simulated Nuclear Pulse Testing at Kirtland AFB, New Mexico in conjunction with the AF Weapons Laboratory (AFWL). At the AFWL request and expense, a B sensor was designed and installed on the nose boom to calibrate the AFWL Vertical Polarized Dipole (VPD-II) near and far fields in ground and flight tests. The certification of the structural integrity of the boom with this device (pictured below) was accomplished on an accelerated schedule from late December 1983 through January 20, 1984 with intensive work between LaRC Systems Engineering and Special Projects Office.



Operational details of the AFWL flight tests are discussed in Winebarger's paper: AIAA 84-2498 "Flight Test Techniques for Validating Simulated Nuclear Electromagnetic Pulse Aircraft Responses": Winebarger and Neely, Oct. 31, 1984.

One result of the SNEMP test was the instrumentation of about 30 "internal" test points by the AFWL for comparison of Lightning and Nuclear Electromagnetic Pulse signatures. Internal test points measurements of lightning EMP were made in 1984, and will continue to be made in 1985 and 1986, since only 12 channels of fast transient recordings are available. (In preparation for the SNEMP testing and the AFWL made available in mid 1983 a 12 channel recording capability (LeCroy) to replace the 2 channel Biomation system previously carried.)



Technical results were reviewed by AFWL and its contractors at a meeting at Stanford Research Institute in late November 1984. Comments include Phil Krider, University of Arizona:

"You have some magnificent data... . In the last 5 years the lightning area has made the greatest strides in understanding of all branches of meteorology. The F-106 and Convair 580 programs are making tremendous contributions."

Joe Nanevich, Stanford Research Institute, commended our group "...for sticking to the job for enough years to mature and produce useful data." Both Lt. Andersh and Col. Garrison, AF Weapons Laboratory, were highly pleased. Col. Garrison stated he was satisfied with the LaRC/AFWL interface and agreeable to the proposed data availability dates. Col. Garrison expects to keep the AFWL 12 channel LeCroy recording system on the F-106B for the next 2 years. One thing stressed in the meeting was the need for more complete definition of lightning entry - exit geometry.

## 2. Problems.

Several significant problems occurred during the 84 thunderstorm season. These include:

DLITE overheating below 20 KFT.

Radar failure.

Radome coating problems.

These problems were solved in mid-season with some downtime, and a lot of hard work as reported in the "Weeklies":

Cooling:

March 11, 1984

- 0 Reviewed need, techniques, and schedule for increasing Weapons Bay cooling; need will become acute by June when low level penetrations start. (Flight at Weapons Lab with 12-channels reached 100°F limit after 1 hour.) Airworthiness Review Board Chairman estimates July delivery of mod; investigating contract engineering to secure June 1 installation.

June 17, 1984

- 0 Reviewed new Dlite cooling system design with R. Winebarger, B. Fisher, F. Pitts, C. Eichelberger, G. Wood, and others to determine quickest and cheapest way to test for water "spray" ingestion by the LeCroys. Pending resolution, the cooling scoop orifice has been plugged to permit additional high altitude testing.

June 24, 1984

- 0 Devoted considerable time to determining how to test DLite cooling system without risking water ingestion. Plan is now to deactivate three LeCroy Crates and test with one Crate active. Lt. Andersh, AFWL, Kirtland AFB, stated they would be responsible for any damages. This will be tried as soon as suitable internal baffles can be installed.

July 8, 1984

- 0 Flew Flights:

84-033 Neely/Rondeau, Martinsville, 35 kft, 13 hits. First time with DLite cooling scoop open and one DLite Crate operating; no water ingestion.

84-034 Brown/Winebarger. Clear Air Test Flight with all DLite Crates operating. From sea level to 35 kft, it appears that with the vent open, the temperature rise is 40°F.

July 29, 1984

- 0 Reworked DLite cooling system to provide more cooling to power supplies; also relocated overtemp sensors to power supply area, because of thermal shutdowns on last flight.
- 0 Flew flights 84-040, Neely/Winebarger, Mathews 15 kft, NO HITS.  
84-041, Neely/Fisher, Rehobeth, 15 kft, NO HITS.  
84-042, Neely/Winebarger, Belvoir, 15 kft, NO HITS.  
No thermal shutdowns were experienced in any of these flights.

Radome Diverter Strips and Radar Failure:

October 3, 1983

- 0 Advised by J. A. Plumer of Lightning Technologies, Inc., that the present F-106B radome is approaching "electrical wear out" and should be replaced. The radome on the A model will be inspected for use as a replacement. Full-length diverter strips will be added to prevent this "wear out" in the future.

October 24, 1983

- 0 J. A. Plumer of Lightning Technologies, Inc. (LTI) completed the F-106B wing fuel tank lightning safety inspection. Minor anomalies were found and corrected by F-106B crew. Plumer recommends installation of diverter strips to radome to prevent future lightning damage. Flight Control Systems Division personnel are concerned with possible adverse consequences to I and i sensors. LTI to analyze several NASA data sets to determine possible effects of diverter strips to current sensors.

June 17, 1984

- 0 Visited by J. A. Plumer, Lightning Technologies, Inc., to review F-106B radome diverter strip status. Advised by him to use thinner bond lines (5 mils) and an erosion resistant coating lapped over the edges. Procured said coating and applied it Saturday. The 72-hour cure period will permit the next flight by Wednesday, June 27 @ 1:00 p. m.

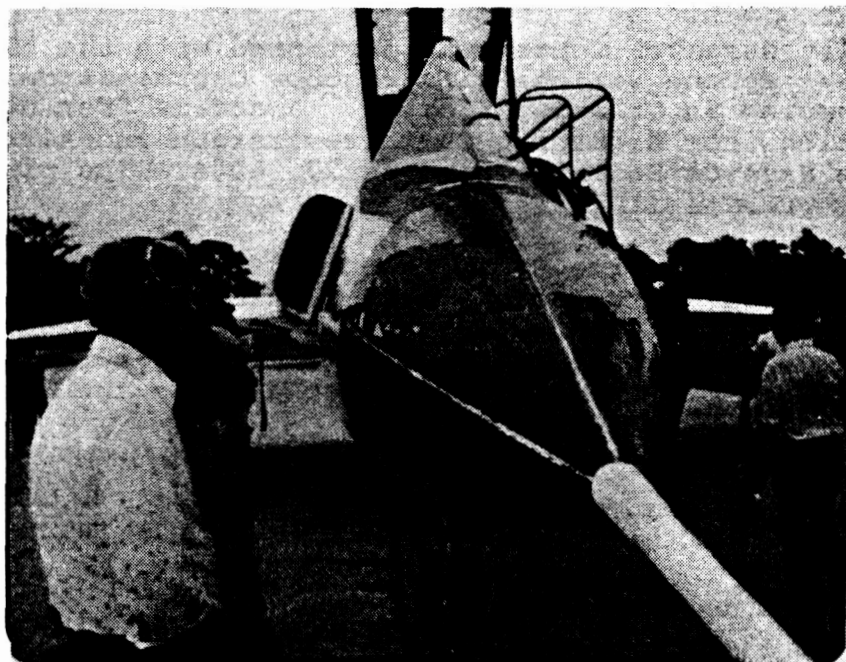
July 8, 1984

- 0 Much discussion with in-house radar experts (Bendix, Plumer, Brunswick Corp., and others) regarding possibility that recent airborne radar failures were due to high reflected energy from the diverter strips back into the front-end of the radar receiver. Flight Electronics Division's (FED) (Harrington, Hearn, et al) Voltage Standing Wave Radio measurements indicated not so; they did point out that the use of cabin air for wave guide pressurization could introduce moisture into the wave guide which should be bone dry. It was decided to seal the wave guide and refly the radome with diverter strips, and to install the more sensitive B-80 radar receiver/transmitter. It was decided to test a spare radome in the FED anechoic chamber to determine the diverter strips' effects on signal transmission.

July 15, 1984

- 0 Flew Flight:

84-035 Brown/Fisher, Hopewell, 18,000 ft, 5 hits. First low altitude mission. Extremely heavy rain eroded parts of the radome coating down to bare fiberglass. See photo below.



July 15, 1984

- 0 Bob Young, FED, began preparation to test spare radome and diverter strips in anechoic chamber.

July 22, 1984

- 0 Bob Young, FED, completed anechoic chamber tests of F-106B radome with and without diverter strips.

July 29, 1985

- 0 Advised by Bob Young, FED, that Radio Frequency chamber tests showed diverter strips made only small effects on radar pattern ( $\pm 0.4$  dB).

### 3. Lightning Display on Kavouris Color Weather Radar:

December 18, 1983

- 0 Demonstrated first real-time display of lightning from the LLP System on the Kavouris color weather radar display Thursday, December 22, 1983 at 15:04:20Z.

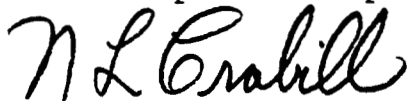
March 18, 1984

- 0 On Wednesday, March 21, reviewed performance of LLP lightning display on Kavouris color weather radar display. Numerous cloud-to-ground lightnings were observed distributed throughout two parallel bands of heavy precipitation north and east of Hatteras. This successfully concludes a significant upgrade undertaken by Blake Avery (Kentron) last fall.

### 4. Awards.

Langley Research Center was presented with the 1984 Award of the Year by the National Interagency Coordination Group at the annual meeting in Orlando, Florida. Award is "For outstanding contributions for Lightning Characterization and Aircraft Lightning Hazards Definition" June 27, 1984. The plaque is on display in the Visitor Center.

Meritorious Service Award by Survival and Flight Equipment Association was presented to the F-106B Storm Hazards Research Flight Crew (Brown, Neely, Keyser, Fisher, Winebarger) "For an outstanding contribution to survival through courage and leadership." This plaque too is displayed in the Visitor Center.



N. L. Crabill

Flight 84-011, May 17, 1984

Familiarization and Functional Check Flight/ Local

Brown

No notes taken.

Enclosure 5

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-011 F-106B

Date May 17, 1984

Crew Brown/-

Engine Start - : - : -

Take-off 17 : 31 : -

Landing 18 : 37 : -

Lightning Systems:

Dlite NU

LeCroy I.1 2 3

LeCroy II.1 2 3

LeCroy III.1 2 3

LeCroy IV.1 2 3

Digital Peak Counter 1 NU 2 NU

Aft movie camera NI

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) NU

X-Ray NI

Los Top NU Aft NI

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft NU 0.5 NU

Non-Lightning Systems:

AIS NU

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft NU 0-5 NU

C-Band Beacon NU

Airborne Radar Video NU

Voice NU

Kavouris Radar

Receiver OK

Region Local

Pens NA

Strikes NA

Nearbys NA

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 011

## Ground-Based

Metro

## Telemetry

Strip Charts NUPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers NUVideotape NUSatellite Pictures OKWallopsSPANDAR NUVideotape                     Digital dBZ Tape                     LDAR NUUHF Radar NUC-Band Tracking NUGoddard Antennas NUGSFC NUWFF NULaRC NTELF Antenna NTLLP NUWFF Plots NULaRC Plots INOPWFF Tape NU

Debrief Notes for Flight 84-012, May 1984

Instrumentation Check Flight/Local

Neely/Fisher

GMT

13:46:07 (Engine Start.)

AIS record 1 - CPT cals (Item 1).

13:53:10 (AIS data on.)  
13:53:11 (Full right rudder.)  
13:53:20 (Full left rudder.)  
13:53:50 (Full nose down stick.)  
13:54:06 (Full right roll stick.)  
13:54:20 (Full left roll stick.)  
13:54:29 (AIS data off.)  
13:56:00 (DLite master power on.)

AIS record 2 - Takeoff (Item 2).

14:10:30 (AIS data on.)  
14:11:30 (Takeoff.)  
14:12:17 (AIS data off at 2000 ft.)

AIS record 3 - Pitch oscillations (Item 3). 5500 ft.

14:20:10 (AIS data on.)  
(Three pitch cycles,  $\pm 5^\circ$ , slow rate, nose up first. Item 3a.)  
14:21:28 (Event to begin, item 3b.)  
14:21:52 (AIS data off.)

AIS record 4 - Roll oscillations (Item 4). 5500 ft.

14:22:20 (AIS data on.)  
(Three roll cycles,  $\pm 10^\circ$ , slow rate, right wing first.) (Item 4a).  
14:23:15 (Event to begin item 4b.)  
14:23:48 (AIS data off.)

AIS record 5 - Yaw oscillations (Item 5). 5500 ft.

14:25:30 (AIS data on.)  
(Three yaw oscillations, nose right first.)  
14:26:02 (AIS data off.)

AIS record 6 - Accel/Decel,  $030^\circ$  (Item 6a), 5500 ft.

14:26:50 (AIS data on.)  
14:27:26 (Event at 225 KIAS.)  
14:27:47 (Event at 300 KIAS.)  
14:27:59 (Event at 350 KIAS.)



14:28:11 (Event at 400 KIAS.)  
14:28:34 (Event at 350 KIAS.)  
14:28:57 (Event at 300 KIAS.)  
14:28:35 (Event at 250 KIAS.)  
(Airplane turns to avoid passing over Wallops. Never reaches 225 KIAS.)  
14:29:46 (AIS data off.)

AIS record 7 - Accel/Decel, 210° (Item 6b).

14:30:40 (AIS data on.)  
14:30:44 (Event at 225 KIAS.)  
14:30:51 (Event at 250 KIAS.)  
14:31:05 (Event at 300 KIAS.)  
14:31:18 (Event at 350 KIAS.)  
14:31:32 (Event at 400 KIAS.)  
14:31:57 (Event at 350 KIAS.)  
14:32:26 (Event at 300 KIAS.)  
14:33:01 (Event at 250 KIAS.)  
14:33:17 (Event at 225 KIAS.)

AIS record 8 - 720° turn at 25° bank (Item 7). 5500 ft.

14:34:50 (AIS data on.)  
14:34:56 (360° turn to right. Event to start at 210°.)  
14:35:18 (Event at 270°.)  
14:36:25 (Event at 360°.)  
14:37:25 (Event at 090°.)  
14:38:22 (Event at 180°.)  
14:38:42 (Event at 210°.)  
14:38:45 (Event to start turn to left at 210°.)  
14:39:03 (Event at 180°.)  
14:40:01 (Event at 090°.)  
14:40:54 (Event at 360°.)  
14:41:55 (Event at 270°.)  
14:42:37 (Event at 210°.)  
14:42:40 (AIS data off.)

AIS record 9 - INS Ground Speed Check (Item 8a).

14:45:20 (AIS data on.)  
(250 KIAS: 5200, 237 Knots G.S. 327°.)  
14:46:24 (AIS data off.)

AIS record 10 - INS Ground Speed Check (Item 8b).

14:47:10 (AIS data on.)  
14:47:23 (Event to start. 5200 ft, 250 KIAS, Knots G.S., 146°.)  
14:48:00 (AIS data off.)  
14:49:10 (Voice recorder on.)  
14:49:16 (Video recorder on.)  
14:49:32 (DLite instrumentation on.)

AIS record 11 - Data Systems Checkout.

14:50:20 (All data on.)  
14:50:33 (Stormscope on.)  
14:50:37 (Change to 40 n.mi. range on stormscope.)  
14:50:58 (All data off.)

AIS record 12 - LeCroy calcs.

14:51:30 (All data off.)  
(LeCroy cal 1: Crate 1 rearmed twice.)  
(LeCroy cal 2:  
(Simulated flame out (SFO) to a touch and go on Runway 04 at WFF.)  
14:55:32 (All data off.)  
(Touchdown and go to Runway 04 at WFF.)  
15:03:14 (DLite instrumentation off.)  
15:03:32 (Voice recorder off.)  
15:03:40 (Video recorder off.)

AIS records 13 and 14 - Data bursts using master data switch.

(AIS data on.)  
(AIS data off.)  
15:06:23 (DLite master power off.)

AIS record 15 - 300 KIAS low pass (Item 13).

15:12:40 (AIS data on.)  
15:14:43 (Event at approach end.)  
(300 KIAS, 500 ft, 288 knots G.S.)  
15:15:03 (Event at departure end.)  
15:15:10 (AIS data off.)

AIS record 16 - 400 KIAS low pass (Extra Item).

15:17:20 (AIS data on.)  
15:17:46 (Event at approach end.)  
(400 KIAS, 500 ft, 394 knots G.S.)  
15:18:01 (Event at departure end.)  
15:18:08 (AIS data off.)

AIS record 17 - Landing.

15:25:00 (AIS data on 2000 ft.)  
15:25:39 (Touchdown.)

AIS record 18 - Chocks.

15:29:10 (AIS data on.)  
15:30:28 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 012 F-106B

Date May 18, 1984

Crew Neely/Fisher

Engine Start 13 :46 :07

Take-off 14 :11 :30

Landing 15 :25 :39

Lightning Systems:

Dlite NU

LeCroy I.1 2 3

LeCroy II.1 2 3

LeCroy III.1 2 3

LeCroy IV.1 2 3

Digital Peak Counter 1 OK 2 OK

Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera NI

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) NU

X-Ray NI

Los Top TBD Aft NI

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Local

Pens NA

Strikes NA

Nearbys NA

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84-012

## Ground-Based

Metro

## Telemetry

Strip Charts NUPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR NUVideotape                     Digital dBZ Tape                     LDAR NUUHF Radar INOPC-Band Tracking OKGoddard Antennas NUGSFC NUWFF NULaRC NIELF Antenna NILLP NUWFF Plots NULaRC Plots INOPWFF Tape NU

STORM HAZARDS '84 AIRCRAFT SQUAWK SHEET

Flight No. 84-012

Date: May 18, 1984

1. Loose canopy seal.
2. Need to verify rudder trim.

Debrief Notes for Flight 84-013, May 24, 1984

Storm Flight/Casanova VORTAC, (Warrenton, VA.)

Neely/Winebarger

GMT

AIS Record 1 - Takeoff.

18:04:20 (AIS data on.)  
18:05:15 (Lift off.)  
18:06:02 (AIS data off.)

AIS Record 2 - Penetration 1.

18:27:07 We are in a storm here and the radar is blank.  
18:27:10 (Data on.)  
18:27:11 METRO: Cloud entry.  
18:27:20 Just broke out.  
18:27:27 Off to right there - just point nose over there a little bit. Want to turn data on?

18:27:37 METRO: 816 if you come around to a heading of 40° and  
about 15 nautical I think you'll be in the worst of it.  
18:27:38 (Data off.)  
18:27:44 I see what you are talking about but we are 31 and we are  
essentially on top. I'm going to drop down to about 29,500 ft  
or so.

18:28:00 I still don't have anything on the scope.  
18:28:04 METRO: We show you running right up the line now in head-  
ing 040°.

18:28:58 I finally see one on the radar. It's 20 miles at 1 o'clock.  
18:29:03 METRO: We are showing field mill activity.  
18:29:06 We're getting bounced around a little bit. Looks like most  
of the stuff is below us. I'm looking at 2° down tilt.

18:29:14 METRO: Try to go down lower.  
18:29:20 SPANDAR: We show a small area of level 5 due east of your  
position 10 miles, a small area level 5, due south 5 miles.  
18:29:30 Got an approximate altitude on that?  
18:29:39 Roughly your altitude. We're scanning your altitude. It's  
roughly just below you. I don't have an absolute top  
type measurement.

AIS Record 3 - Penetration 2

18:29:40 (Data on.)  
18:29:56 METRO. The field mill activity was sorta respectable, if  
you can go back thru that same patch of sky at 27,000 ft,  
it might be interesting.

18:30:06 See what I can do.  
18:31:03 It's amazing we see that kind of return on national weather

service system and not on ours.  
18:31:17 We're above the liquid.  
18:31:36 Also in the clear.  
18:31:37 (Data off.)  
18:33:01 There's some yellow. At least we know the radar will show yellow.

## AIS Record 4 - Penetration 3.

18:33:20 (Data on.)  
18:33:29 I got the storm dead ahead at 15 miles.  
Data on.  
18:33:32 Starting to get bumped around a little bit now.  
18:33:42 Flashes.  
18:33:47 METRO: Good field mill.  
18:33:58 A good one out there at 20.  
18:34:06 Seem to be skirting the left edge.  
18:34:24 A little yellow out there.  
18:34:34 20 miles.  
18:35:20 Range is 10 - 2° down. Lost my return. Must be below us.  
18:33:30 Go back to 20. Still 2° down. Got a green dot at 10.  
18:35:40 Got some yellow off to right at 20 there too and 7° right.  
18:35:48 That's what we had before. Go to 10 we'll lose it I bet.  
18:36:20 METRO: Can we go back thru another 2000 ft lower? What do you see dead ahead on your radar, 12 o'clock 20 miles?  
18:36:47 We see nothing. I'm on 20 mile range. Got a small green dot 12. It will go away as we get closer.  
18:37:03 METRO: See if you can get lower altitude and go back - reciprocal course.  
18:37:37 There's green dot at 15. I'll keep pointing toward it. Might find something. Must be on top of something.  
18:37:53 A good little bump there.  
18:37:56 METRO:.... Thousand for reciprocal?  
18:38:12 We must be in bumpy air anyway.  
18:38:19 We had pretty continuous chop and occasional bump riding here.  
18:39:22 That wasn't me. That was a sizeable down draft.  
18:40:06 (Data off.)  
18:40:30 Out of clouds now.  
18:40:50 I have third penetration. Short burst when we got into it.  
18:42:33 Look at 40 mile range see if anything out there.  
18:42:52 Yeah, you got a line of stuff coming around.  
18:44:13 Fuel check is 5.8.  
18:44:17 METRO: We copy that within a 100 lbs. Bill, on the heading you are now on, you really don't get anything significant until you go 30-35 miles. Then you start getting into some level 4. Let me know what you see on your radar. The level 4 starts around Baltimore.

## AIS Record 5 - Penetration 4.

18:44:20 (Data on.)  
18:44:41 You've got some yellow about 12 miles.  
18:45:11 Looks like your line laying now about 28° to right.  
18:45:35 SPANDAR: I see some level 4, small area, about 10 miles, 025° from your position.  
18:45:42 We're heading 050° now.  
18:45:56 SPANDAR: We're roughly looking 5,000 ft below your altitude.  
18:46:08 Some pretty good bumps here now.  
18:46:15 METRO: Mildly interesting field mills, nothing spectacular yet.  
18:46:31 First precip I've heard today.  
18:46:42 METRO: Any flashes?  
18:46:44 Negative.  
18:46:47 METRO: Stormscope dead?  
18:46:49 Nothing on stormscope at all.  
18:47:09 Getting bounced around pretty good now.  
18:47:50 Well. Rog. I got a blank screen for 20 miles, showing. What do you show?  
18:47:56 I show a blank out to 25, than a big blob of green over the rest of it.  
19:48:21 Looks like we right on back side of this thing at first doesn't it.  
18:48:36 Looking at 40 miles, 2 down on tilt, in right turn, am showing a blob of yellow, and coming right about 20.  
18:48:59 Right on the nose is a little spot of yellow.  
18:49:01 That's that I'm trying to shoot for.  
18:49:28 METRO: The track is deviating from line of storms. Say intentions.  
18:49:35 The only thing we see is at 12 o'clock, 25 miles.  
18:49:43 I think we are offset to left of storm. I think you got to run a parallel course to the green that's off to the right.  
  
18:50:14 Accounting for the attenuation in the boom. The radome, I show us splitting the yellow right now.  
18:50:22 Out at 20 miles?  
18:50:24 Yeah.  
18:51:01 Now it's off to right.  
18:51:06 Come on William.  
18:51:10 I think if you stay here you'll get it.  
18:51:31 12 o'clock, 14-15 miles. Maybe 5-6 miles in diameter. 3 & 4.  
18:52:06 SPANDAR: There is some level 5 in that. It's about 5 miles from you, bearing 045°. We're looking about 24,000 ft but we do see level 5.  
18:52:18 Heading 072° now.  
18:52:34 SPANDAR: They are almost due east of you, about 4 miles. We see some level 6 also, below you.  
18:52:45 We show 4 & 5 on 10 miles. Got a few flashes now.  
18:53:00 We are entering the contours that we see.



18:53:03 METRO: Sharp field mill excursion there.  
18:53:04 A flash too.  
18:53:05 We're in the storm.  
18:53:10 We're in the cell. Pretty good rain.  
18:53:13 Flashes.  
18:53:16 Heavy rain.  
18:53:17 Real heavy rain.  
18:53:19 Pretty heavy rain now.  
18:53:20 Strong updraft.  
18:53:23 Flashes.  
18:53:42 METRO: Turn around, go back in again. It looks good.  
18:53:50 (Data off.)  
18:54:14 Do you need 3½ minutes between penetrations today?  
18:54:30 Negative.  
18:54:38 This one, Rog. we want to watch. That sucker could grow.  
18:54:50 All we got to do is stay between 24 & 25.  
Looking 5,000 lbs gas.  
18:54:57 Range to home please.  
18:55:04 METRO: 146 from home.  
18:55:08 METRO: We expect some light rain activity in next 10 minutes, but you don't have to come here right away. So it might be gone by the time you get here.  
18:56:27 SPANDAR: Level 5 about 270° your position 4 miles.  
18:56:34 That checks, we see level 4. We are aiming to left of that.

## AIS Record 6 - Penetration 5.

18:56:40 (Data on.)  
18:56:43 SPANDAR: There is also a small area of level 5 due south of the big area by about 3 or 4 miles that might not show to you.  
18:56:57 I think I know where it is just by looking at it.  
18:57:07 245 on altitude.  
18:57:12 Back in, got precip.  
18:57:17 Flashes.  
18:57:21 Pretty good bumps.  
18:57:56 Looks like you got a lot over here 15° left.  
18:58:04 My radar is not showing anything.  
18:58:09 There's a whole line of yellow.  
18:58:11 I don't see that.  
18:58:25 It's going away - as we get close.  
18:58:44 Maybe I'll break out here. I'm hoping I will - makes it easier to turn.  
18:59:41 (Data off.)  
19:00:09 METRO: What's your heading for this penetration going to be?  
19:00:14 I think it's going to be 080°.  
19:00:27 Why don't you zoom this area on Kavoris and send it up to us?  
19:00:44 Still raining. 2° down 20 mile range.

19:00:54 Rog, can you see how the paint is holding up?  
19:00:58 No. I can't really.  
19:01:17 Heading will be about 055°.  
19:01:41 What do you want to use as BINGO, Norm?  
I've got 48 now.  
19:02:03 METRO: In about 8 minutes you should start home.

## AIS Record 7 - Penetration 6.

19:02:10 (Data on.)  
±9:02:12 SPANDAR: 045° about 8 miles, level 5.  
19:02:17 I see what you are talking about. We show level 4.  
19:02:31 24-5, 055° storm is 3 miles. Appears to be less intense  
than before.  
19:02:52 In the storm.  
19:02:59 Percip.  
19:03:02 Flashes.  
19:03:08 METRO: Not much field mill.  
19:04:01 (Data off.)  
19:04:30 METRO: Looking at distance and fuel burn, I think  
it's about time to come home.  
19:05:48 METRO: We are getting a light shower here.

## AIS Record 8 - Dlite Cals.

19:07:20 (Data on.)  
19:07:27 METRO: 816 Metro, are you putting the calibration on?  
19:07:31 Affirmative.  
19:07:39 METRO: Let us know - you give us heart failure.  
19:09:06 (Data off.)

## AIS Record 9 - Landing.

19:33:10 (AIS data on.)  
19:36:14 (Touch down.)  
19:36:55 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-013 F-106B

Date May 23, 1984

Crew Neely/Winebarger

Engine Start 17 : 33 : 7

Take-off 18 : 05 : 15

Landing 19 : 36 : 14

Lightning Systems:

Dlite 0 triggers

10ns LeCroy I.1 D<sub>F</sub> 2 B<sub>W,L</sub> 3 INOP

10ns LeCroy II.1 D<sub>T</sub> 2 i 3 B<sub>L</sub>

10ns LeCroy III.1 D<sub>W,R</sub> 2 D<sub>W,L</sub> 3 D<sub>F</sub>

10ns LeCroy IV.1 TP1012 I<sub>N</sub> 3 I<sub>T</sub>

Digital Peak Counter 1 I=0 2 D<sub>F</sub>=0

Non-Lightning Systems:

AIS OK

INS OK

Telemetry: Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera NG. Overexposed

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) E<sub>X</sub> INOP

X-Ray NI

Los Top TBD Aft NI

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region CASANOVA VORTAC,

VA. (Warrentown.)

Pens 6

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-013

## Ground-Based

Metro

## Telemetry

Strip Charts OK

PCM Data OK

## Kavouris System

Basic Display OK

INS Overlay OK

Triggers OK

Videotape OK

Satellite Pictures OK

Wallops

SPANDAR OK

Videotape OK

Digital dBZ Tape OK

LDAR INOP

UHF Radar INOP

C-Band Tracking OK

Goddard Antennas OK

GSFC NU

WFF NU

LaRC INOP

ELF Antenna NT

LLP PINOP

WFF Plots OK

LaRC Plots INOP

WFF Tape OK

Debrief Notes for Flight 84-014, May 27, 1984

Storm Flight/Rocky Mount, NC

Brown/Fisher

GMT

16:06:35 (Engine start.)  
16:08:45 (DLite master power on.)

AIS Record 1 - Takeoff.

16:17:50 (AIS data on.)  
16:18:44 (Takeoff.)  
16:19:26 (AIS data off at 2000 ft.)

16:31:35 (DLite instrumentation on.)  
16:32:11 (Voice recorder on.)

The nearest activity to us is about 240° at 18 miles. I'm looking down 4 or 5° to see it. I'm out of 34 to 35. We're on top of everything but a little white cloud layer. Looks like we're going to be too high for this near cell, at least.

METRO: Let's skip it, and go to the further one. What does it show on your radar?

I'm not sure. I'm looking down so far, I'm getting ground return. It looks about 30° right at 30 mi.

METRO: That's it. Are you in the clear or in clouds?

Thin clouds above the cells. Mostly in the clouds.

METRO: I assume that's the anvil then, I hope.

METRO: Looks like it's bearing about 260° from you now.

METRO: Report we had, the top on that storm is 50,000 ft. Even if it's 40, it's pretty good.

We are not in the clear, so we can't really see it. Got some return now about 275° from me at 21-22 mi.

16:34:24 (Video recorder on.)

16:34:25 METRO: Your radar shows what level?

16:34:29 Looking down almost 4°. All I see is green.

16:34:33 METRO: Suggest you look at it fairly straight, not too much tilt, see what it shows.

16:34:38 A tiny little patch of green if I look level.

16:34:52 METRO: Escape heading on this would be to the north, 360°.

16:35:23 Data systems armed. Ready to come on. Stormscope, voice and video on.

16:35:32 METRO: Starting to show field mill activity.

16:35:34 Getting a little bit darker. Not much.

16:35:37 Turbulence a little bit rougher.

AIS Record 2 - Penetration #1, FL 350, 275°.

16:35:45 Bring data systems on.

16:35:57 All 3 tape recorders running.

16:36:08 Nearest stuff going out of sight. About 5 miles.

16:36:10 (AIS and DLite data on. Time code stable. Cloud entry.)  
16:36:18 METRO: Seeing any flashes?  
16:36:20 Negative.  
16:36:21 Why don't we bring camera on?  
16:36:25 Camera systems on. (External camera on.)  
16:36:31 Light chop, no rain.  
16:36:33 Now light rain.  
16:36:45 Continuous light turbulence and light rain.  
16:36:57 Might have been a flash overhead.  
16:36:59 Yeah, there were some flashes.  
16:37:12 Getting much brighter.  
16:37:23 Camera system off. (External camera off.)  
16:37:25 Starting 90°-270° to right.  
16:37:32 We're in the clouds, and it is very light in here. Nothing significant on the scope.  
16:37:39 METRO: I think this is the one to work. Proceed with your 90°-270°. (AIS and DLite data off. Cloud exit .)  
  
16:38:26 All data systems are off during the turn.  
16:39:16 METRO: If you don't get anything on this penetration, I'm going to ask you to go up higher... as high as you think reasonable.  
16:39:27 Metro, we had to look down 5-6°, to see that cell even in as close as 5 miles. Then it started going out of sight. I don't think we're going to have any reflectivity showing if we go up higher.  
16:39:44 METRO: OK, stay where we are then.  
16:39:50 If anything, I'd recommend we go to (FL) 330.  
16:39:53 METRO: OK, try that.  
16:40:56 That cell that's 15 miles ahead, I'm still looking down 5° at it.  
16:41:01 And it's only green.  
16:41:03 Metro, the cell that is of interest, I think, is about 13-15 miles ahead. I'm looking down 5°. All I can see is green. If I look level, it just about goes away.  
16:41:16 METRO: It's getting a little bit smaller on my picture, too. We just have to do the best we can with it.  
16:41:29 Bring data systems on now.  
  
AIS Record 3 - Penetrations #2 and #3, FL 330.  
  
16:41:47 Data systems on for penetration #2.  
And Flight level 330 heading 080°.  
16:41:50 (AIS and DLite data on. Time code stable, Cloud entry .)  
16:41:54 Continuous light turbulence, but very bright.  
16:42:08 METRO: We're getting some field mill excursions.  $E_y$  and  $E_Q$ .  
16:42:12 The clouds are moderately darker. Turbulence picking up to occasional moderate.  
16:42:25 Camera system on. (External camera on.)  
16:42:31 Might have been a nearby flash overhead.  
16:42:38 METRO: Field mills are interesting.  
16:42:40 Continuous light turbulence, very light rain.  
16:42:56.2 (LeCrois 2-4 trigger.)  
16:42:58 METRO: Get a hit?  
16:43:00 Not that we know of.  
16:43:02 I do have triggers on board the ship.

16:43:05 METRO: First hit of the year, guys.  
16:43:08 Can't prove it by the cockpit crew.  
16:43:11 METRO: We got T1 showing a light. T1 did not go off, but the other 3 did.  
16:43:17 We got rearm.  
16:43:22 Camera off. (External camera off.)  
16:43:25 I don't see anything out ahead that's interesting; should I do a 90°-270°?  
16:43:30 METRO: Yes sir. We got a hit in it.  
16:43:38 METRO: Doesn't that feel good?  
16:43:41 Doesn't feel like anything to us. We can't tell we got hit.  
16:43:45 METRO: We measured it.  
16:44:04 Metro, in our 90°-270°, we are going to pick up a couple of echoes that are about 11 miles ahead, bearing about 140° from us. (Clear stormscope.)  
16:44:05 METRO: What level do you see in it? It doesn't look as good as  
16:44:14 where you were - on radar.  
16:44:20 It looks better than what we had, but it is still only green.  
16:44:27 The camera was running during the alledged hit.  
16:44:32 METRO: I want to remind you, you are leaving an area where you got hit.  
16:44:35 I'm not going out of my way to it. I'm just doing my 90°-270°; if it works out, OK.  
16:44:45 METRO: There is an area about 15 mi. south of you that is starting to show level 3. It may be the growing area. When you come out of this one, I may give you another vector.  
16:45:25 METRO: Showing field mill activity.  
16:45:33 Cameras on.  
Nearby flash. (External camera on.)  
16:45:36 METRO: You get a hit?  
16:45:39 We got at least a nearby.  
16:45:42 (Event. End Penetration #2. Begin Penetration. #3.)  
16:45:50 Calling this penetration #3. 33,000 ft.  
16:46:01 At the time of the flash there were no triggers indicated and we were in light to moderate turbulence.  
16:46:12 Camera off. (External camera off.)  
16:46:16 Showing about 6.8 for fuel.  
16:46:45 Heading will be about 250°-270°, I suspect.  
16:47:17 (Clear stormscope.)  
16:47:20 Stormscope not providing any information at all. It's giving radial spread left wing tip to right wing tip.  
16:47:45 270° will be heading, about 11-12 miles.  
16:47:57 Cycle data to indicate new penetration.  
16:48:00 METRO: What do you see on radar, dead ahead?  
16:48:02 We see level 1 and a little level 2. Looking down about 7°. It's kinda going away. (AIS and DLite data off.)  
  
16:48:15 METRO: Level 2? What color is that?  
16:48:18 It was showing some yellow for a while now only green. Now it's going away completely.  
  
AIS Record 4 - Penetration #4, FL330, 275°.  
  
16:48:20 (AIS and DLite data on. Cloud entry. )

16:48:29 Cycled data - Penetration #4, FL330, heading 275°.  
16:48:41 Data systems are on.  
16:48:45 Camera is on. (External camera on.)  
16:48:55 METRO: Field mills are moving around.  
16:48:57 Continuous light turbulence. No rain.  
16:49:00 Now light rain.  
16:49:04 METRO: Hit? Nearby?  
16:49:06 Not confirmed up here.  
16:49:09 METRO: Nearby.  
16:49:11 It's so bright, it's hard to see any lightning flashes, if there are any.  
16:49:44 METRO: The cell to the south has diminished. My guess would be to stay where we have been hit before.  
16:49:55 Roger, starting 90°-270°.  
16:50:00 METRO: We're showing field mill.  
16:50:07 Data systems off. (All data off. Cloud exit.)  
  
16:50:37 Little turbulence here.  
  
AIS Record 5 - Penetration #5, FL330, 090°.  
  
16:50:50 Data systems on, but no camera for penetration #5 as we are in light turbulence and light rain in the clouds.  
16:51:07 There have been no cloud entries or cloud exits.  
16:51:10 (AIS and DLite data on. Time code stable. Cloud entry.)  
16:51:35 Weapons bay temperature 80°.  
16:51:45 (Clear stormscope.)  
16:52:35 Partial cloud exit on right.  
16:52:47 METRO: The Kavouris system shows the cell just to the east of you. Your target storm is picking up in intensity again, so I think you better stay right there.  
16:53:44 (Clear Stormscope.)  
16:53:55 Continuous light turbulence almost no rain. Heading now 090°. FL330. Still penetration #5.  
16:54:07 Looking down about 7°. Nearest return about 10 miles.  
16:54:18 There's a flash.  
16:54:30 Looking down 6°, and I got some yellow in this return at 14 miles.  
16:54:48 Camera on. (External camera on.)  
16:55:23 Turbulence picking up a little bit - Continuous light. Little bit of rain.  
16:55:35 Nearby flash.  
16:55:46 91 miles out.  
16:56:24 Calm and dry now.  
16:56:29 Camera off. (External camera off.)  
16:56:30 Metro, I see 2 cells. One bearing 100° and the other 120° from me at 15 miles. Are they significant?  
16:56:36 (LeCroys 2-4 trigger.)  
16:56:45 METRO: You just got a trigger.  
90°-270° back where you are.  
16:57:44 METRO: SPANDAR advises 43000 tops 15 miles behind you.  
16:57:53 I hear it, but I don't believe it.  
16:57:56 Neither do I.  
16:58:08 45 is an awful soft 45000.



16:59:54 31(kft)  
17:00:01 (AIS and DLite data off. Cloud exit.)

17:00:22 All data systems off now.  
17:00:29 The best cell looks to me off to right at 18 miles.  
17:00:33 I see it. May be a little yellow in there.  
17:00:40 Looking down 5°.  
17:00:47 Bring data on - getting a little bouncy here.

AIS Record 6 - Penetration #6, FL310, 290°.

17:00:59 Data systems on for Penetration #6. FL310. Heading 290°.  
17:01:09 Small green cell ahead with small core of yellow, about 10 miles.  
17:01:10 (AIS and DLite data on. Time code stable. Cloud entry.)  
17:01:25 Camera system on. (External camera on.)  
17:01:31 Metro, how are you reading and how is TM at this altitude?  
17:01:50 METRO: I'm reading you fine, and getting good telemetry down here - good and solid.  
17:01:56 Level at 310, and about to penetrate.  
17:01:59 METRO: We are starting to show field mill. You are only about 75 miles from us.  
17:02:08 I indicate 85 (n.mi.) from home.  
17:02:10 I show 87.  
17:02:15 Clouds getting darker. Very light rain, occasional light turbulence.  
17:02:20 I saw a distant flash.  
17:02:25 Some rain now.  
17:02:28 Seeing continual light rain and continual light turbulence.  
17:02:34 About the heaviest rain we've seen today.  
17:02:35 Didn't last long.  
17:02:46 I think that was it.  
17:02:53 Turn camera off. (External camera off.)  
17:03:01 Pretty good bump.  
17:03:03 METRO: Did you get anything?  
17:03:05 Not that we know of. A distant flash, we think we saw.  
17:03:12 METRO: Starting to get drop out, we think.  
17:03:16 We are in turn 90°-270°.  
17:03:19 METRO: That explains it.  
17:03:36 METRO: The Kavouris shows no level 3 now. Just level 2, and I propose we just keep trolling on that line until we see what happens.  
17:03:53 Got some turbulence, so keeping the data systems on except camera.  
17:04:03 (Clear stormscope.)  
17:04:05 We don't have direct read out of camera time do we?  
17:04:08 No.  
17:04:46 About 5.6 on fuel.  
17:05:03 Data systems off now.  
17:05:04 (AIS and DLite data off. Cloud exit.)

AIS Record 7 - Penetration #7, FL310, 110°.

17:07:23 Data systems on for penetration #7. FL310, Heading 110°.  
17:07:30 Antenna tilt -5°. About -7° there. (AIS and DLite data on.)

Time code stable. Cloud entry. )  
17:07:40 Continuous light turbulence, but a dry ride.  
17:07:47 Camera on. (External camera on.)  
17:08:10 Only green.  
17:08:13 Turbulence picking up to continuous light and continuous light rain.  
17:08:18 Good moderate bounce.  
17:08:25 Nearby flash.  
17:08:28 METRO: We saw it.  
17:08:32 Continuous light turbulence with some moderate chop, and continuous light rain.  
17:08:45 Light to moderate turbulence.  
17:08:50 Got another cell at 16 mi.  
17:08:53 I see. And another one slightly right of course.  
17:09:00 Metro, we got a return about 15° right, at 20 mi. Want us to look at that, or stick with what we've got.  
17:09:27 METRO: What color is that return?  
17:09:29 Got some yellow in the center right now.  
17:09:32 METRO: Go for it.  
17:09:40 METRO: Keep data on.  
17:09:44 Camera system off. (External camera off.)  
17:09:48 That was the first bright flash today.  
17:10:00 On the nose now about 11 mi.  
17:10:05 All green at this tilt.  
17:10:06 Got a little yellow in it. Occasionally.  
Looking down about 7°.  
17:10:25 Got another cell off to left.  
17:10:46 This one has gone away completely. Looking down about 10°.  
Can't see it.  
17:10:54 Going to start turn to try pick up other cell.  
17:10:59 We are passing the position now of that cell we saw with virtually no change in conditions. Calm and dry. Now making left turn towards East to pass through a pretty good size cell with green and yellow.  
17:11:12 METRO: Kavouris indicates the only cell with level 3 is 180° behind you now. Where you have been trolling.  
17:11:22 We are going to continue this left turn around to pick up the cell Kavouris is seeing.  
17:13:02 (Clear Stormscope.)  
17:13:10 (AIS and DLite data off. Cloud exit .)  
17:13:11 I have some return now at 14 miles, 14 to 18.  
17:13:20 METRO: I show it about 10 miles to level 3.  
  
AIS Record 8 - Penetration #8, FL310, 300°.  
17:13:30 (AIS and DLite data on. Cloud entry .)  
17:13:31 We have it, and are headed that way.  
17:13:41 Data systems cycled now for penetration #8. FL310, Initial heading 280° now to 300°.  
17:13:55 Showing some return at 5° down.  
17:14:14 No return on stormscope.  
17:14:20 Going to -7° on tilt.  
Turn camera on.

17:14:26 You got it. (External camera on.)  
17:14:49 Stormscope showing points right to left in straight line. It's been doing that all day, every penetration.  
17:15:04 Getting darker as we enter the cell.  
17:15:07 Continuous light turbulence, very light rain.  
17:15:25 Continuous light rain. Continuous light to moderate turbulence.  
17:15:32 Fairly significant updrafts there.  
17:15:36 Nearby flash.  
17:15:40 Might have been another one.  
17:15:46 Gets brighter. Rain falls off. Turbulence goes to continuous light.  
17:15:53 METRO: 90°-270° back in that area as quickly as you can.  
17:16:00 Camera off. (External camera off.)  
17:16:29 (AIS and DLite data off. Cloud exit .)  
  
17:16:30 Data off.  
17:16:55 METRO: I estimate we have time to do one more complete cycle. One more east bound, one more west bound, and then home.  
17:17:04 I concur.  
17:19:03 -7° on tilt. Some return at 11 miles.

## AIS Record 9 - Penetration #9, FL310, 100°.

17:19:30 (AIS and DLite data on. Cloud entry .)  
17:19:34 Data systems on. Penetration #9, FL310. Initial heading 100°.  
17:19:55 Continuous light turbulence.  
17:20:05 Camera on. (External camera on.)  
17:20:13 It's dry, but continuous, light, turbulence. Very bright clouds.  
17:20:30 Getting darker. Light rain has started. Continuous light turbulence.  
17:20:39 METRO: Good field mill.  
17:20:48 May be nearby flash. Other conditions unchanged.  
17:21:13 Camera off. (External camera off.)  
17:21:23 Conditions still unchanged.  
17:21:50 Metro, we have some yellow in the return that bears 110° at 20 from us. Want us to pick that up before we turn west bound?  
17:22:18 -5° tilt.  
17:22:22 (Clear stormscope.)  
17:22:41 SPANDAR: Metro wants you to repeat message.  
17:22:45 (Message repeated.)  
17:22:55 METRO: Go ahead.  
17:23:04 -5° on tilt.  
17:23:20 Camera on. (External camera on.)  
17:23:59 Camera off. (External camera off.)  
17:24:25 (AIS and DLite data off. Cloud exit. )

## AIS Record 10 - Penetration #10, FL310, 300°.

17:27:51 Data on for penetration #10, FL310, Heading 300°.  
Continuous light turbulence.  
17:28:00 (AIS and DLite data on. Time code stable. Cloud entry. )  
17:28:01 Camera on. (External camera on.)  
17:28:17 Continuous light turbulence and occasional light rain.  
17:29:00 Conditions unchanged.

17:29:26 Camera off. (External camera off.)  
17:30:05 Data off. Still in clouds though.  
(AIS and DLite data off. Cloud exit. )  
  
17:30:43 Cloud exit.  
  
AIS Record 11 - DLite calcs.  
  
17:31:40 (AIS and DLite data on.)  
17:31:41 (DLite cal.)  
(DLite recorder 2 fails- broken belt. Circuit breaker pops.  
Tape recorders stop and DLite will not cal.)  
17:33:12 (AIS and DLite data off.)  
  
17:33:41 (DLite instrumentation off.)  
17:33:52 (DLite master power off.)  
17:34:06 (Voice recorder off.)  
17:34:15 (Video recorder off.)  
  
AIS Record 12 - Landing.  
  
17:44:30 (AIS and external camera on.)  
17:46:16 (Landing.)  
17:47:23 (AIS data off.)  
  
AIS Record 13 - Chocks.  
  
17:50:50 (AIS data on.)  
17:51:55 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-014 F-106B

Date May 27, 1984

Crew Brown/Fisher

Engine Start 16:06:35

Take-off 16:18:44

Landing 17:46:16

Lightning Systems:

Dlite 2 triggers\*\*

10ns LeCroy I.1 INOP 2 INOP3 INOP

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1 INOP 2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I}$  INOP2  $\dot{D}_F$  INOP

\*\*T/R2 Broke belt.

\*\*Blown C/B's during calcs.

Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera NG. Overexposed

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) PINOP.  $E_y$  intermittent.

X-Ray NI

Los Top TBD Aft NI

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Rocky Mount,

NC.

Pens 10

Strikes 2

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-014

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape NUDigital dBZ Tape OKLDAR NU - Too farUHF Radar INOPC-Band Tracking OKGoddard Antennas GSFC NU - Too farWFF NU - Too farLaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-015, May 27, 1984

Storm Flight/Elizabeth City, NC

Brown/Fisher

GMT

20:03:16 (Engine start.)  
20:06:17 (DLite master power on.)

AIS Record 1 - Takeoff.

20:11:36 (Takeoff.)  
20:11:40 (AIS data on.)  
20:12:23 (AIS data off.)  
20:17:58 (DLite instrumentation on.)  
20:19:40 (Voice recorder on.)  
20:19:56 (Video recorder on.)

AIS Record 2 - DLite Cals & Pen #1.

20:20:45 SPANDAR: I show some level 5 southeast of your position about 10 miles; and about 15 there is a very small area of level 6.  
We are currently below your altitude getting ready to come up. Give you an update shortly.  
We are seeing a little bit of yellow, and I have to look 4° nose down to see that. That's at 18 miles ahead.

20:20:50 (AIS & DLite data on.)  
20:20:54 (DLite calcs.)  
20:21:13 We just gave you a Cal sequence.  
20:21:30 A little cell we are about to get into. Want to turn on data?  
20:21:32 Data is on.  
20:21:43 Camera on. (External camera on.)  
20:21:49 SPANDAR: At your altitude, all I see is a level 3, southeast your position - 10 miles.  
We're going thru a very small cell now, and will continue on to get to cell you are talking about.

20:21:51 (Event to begin Pen #1.)  
20:22:05 METRO: We are showing good field mill.  
The best is still about 6 miles ahead.  
Pen #1, 30,000 ft. 160°.  
20:22:20 Still very bright, and occasional light turbulence.  
20:22:35 Light to moderate turbulence. May be a nearby flash.  
20:22:43 Very close flashes.  
20:22:54 Light rain, light turbulence.  
20:22:57 Getting darker, getting heavier. Light to Moderate turbulence.  
20:23:02 Nearby flash.  
20:23:07 Nearby flash.  
20:23:14 We're about thru with that one, I think.  
20:23:20 Camera off. (External camera off.)

20:23:26 There was some lightning in there.  
20:23:35 Metro, do you have a ground track of us?  
20:23:43 Roger.  
20:23:44 What's your opinion of the one we just penetrated  
versus the one that is more to the southwest?  
20:23:50 METRO: This is as good as those and the tops in that  
vicinity were quoted at 48,000, 10 minutes ago. I  
was wondering about the altitude. Go back thru them  
though.  
20:24:09 OK. That 48,000 came from what source?  
20:24:24 (Event for cloud exit.)  
20:24:31 (AIS & DLite data off.)  
20:24:43 METRO: We got the tops from SPANDAR and they might  
be 5 too high. So if you go to 43, you're at 31. I'm  
still looking for anvil stuff.  
We'll go up some. We're at FL 290 now.  
  
AIS Record 3 - Pen #2, North, FL 310.  
  
20:26:50 (AIS & DLite data on.)  
Metro, it looks like the best return is a little bit  
more to the southwest, but we'll go ahead and repenetrate  
this nearby cell. Looks like we ought to reorient on  
a more north-south heading.  
20:27:00 (Event for cloud entry.)  
20:27:26 All data up, but camera.  
20:27:46 SPANDAR: METRO said to continue as you are. May want  
next run east-west.  
20:28:02 (Clear stormscope.)  
20:28:17 Light turbulence now.  
20:28:21 Camera on. (External camera on.)  
20:28:28.8 (LeCroys 1-4 trigger. Direct strike.)  
20:28:29 Direct strike. Everybody triggered. A good one. On  
the left side too. (Audible on tape.)  
20:28:40 METRO: We see an activity.  
Wise guy.  
20:28:43 Lots of nearby flashes.  
20:28:48 Light to moderate turbulence, and light rain at the  
time.  
20:28:55 Camera off. (External camera off.)  
20:29:04 METRO: Since we got a strike there I'd suggest you go  
back, forget the line, 90° - 270° right back in there.  
20:29:25 Camera on. (External camera on.)  
20:29:34 Occasional light turbulence and very light rain.  
20:29:43.3 (LeCroys 1-4 trigger. External camera records a direct  
strike.)  
20:29:44 Continuous light rain, very nearby flashes, and we got  
triggers.  
20:29:50 That was probably a strike.  
20:29:52 Light turbulence, and light rain at the time.  
20:30:04 Camera off. (External camera off.)



20:30:21 (AIS & DLite data off. Cloud exit.)  
20:30:22 All data systems off.  
Cloud exit.

AIS Record 4 - Pen #3, FL 310, 240°.

20:34:49 Data systems on.  
20:34:50 (AIS & DLite data on. Time code stable. Cloud entry.)  
Metro, we have reversed to run back thru the cells,  
but they really seem to have fallen apart from our  
airplane radar. Looks like the best is down towards  
the southwest.  
METRO: What heading from your present position?  
The ones I'm going after right now are 150° from me,  
and the others have gone off the right side the scope,  
bearing about 210° from me, and about 20 miles.  
METRO: Go for it.  
OK. I'll deviate then to go for the better cells.  
20:35:04 Data on for penetration 3, FL 310, heading 240°.  
20:35:19 Camera on. (External camera on.)  
20:35:26 Light rain, light turbulence, and clouds getting darker.  
20:35:33 Nearby flashes.  
Some rain.  
20:35:42 Nearby flashes.  
20:35:49 Distant flashes.  
20:35:58 Rain dying off and still continuous light turbulence.  
20:36:09 Camera off. (External camera off.)  
20:36:46 Doesn't look like much. About 15 miles, about 10° west  
of course.  
20:36:54 Very bright clouds.  
These cloud masses are better defined.  
20:37:00 Cloud exit. (Event.)  
20:37:07 (AIS & DLite data off.)  
They are not very high. We're FL 310, and can just  
about see the tops of everything.  
75 miles out.

AIS Record 5 - Pen #4, FL 310, 080°.

20:38:47 Data systems on. Looks good.  
20:38:50 (AIS & DLite data on. Time code stable.)  
20:38:57 METRO: Field mills picking up, 816.  
20:38:58 (Event for cloud entry.)  
20:39:00 Cloud entry.  
20:39:04 Antenna tilt = -7°.  
Go level - everything disappears. Back to -5°.  
20:39:14 (Event for cloud exit.)  
20:39:16 Momentary cloud exit.  
20:39:30 This one is getting bigger.  
Looking 5° down. Don't see any yellow.  
20:39:44 (Event for reentry.)

20:39:45.3 (LeCroys 1-4 trigger.)  
20:39:50 METRO: Say flight conditions. Lots of field mill.  
20:39:50 We are in wispy stuff around top, approaching  
tunnel in this buildup.  
20:40:04 METRO: 816, were you just calibrating?  
20:40:14 Negative. All lights on.  
20:40:18 METRO: It looks like we got a trigger.  
None of the lights went out up here. I was looking  
when you called.  
Must have been a drop out down there.  
20:40:30 We show it here.  
20:40:41 I don't see any yellow out to 40 miles, even when  
I look down.  
20:40:44 Nearby flashes. Continuous light turbulence and light  
rain.  
20:45:55 A few bounces of moderate turbulence.  
20:41:06 Light rain and light turbulence.  
20:41:29 Camera off. (External camera off.)  
30:41:35 Come left about 20° to pick up one little cell.  
20:42:29 Metro, looks like things are falling apart out here.  
You have any promising looking returns on your display?  
20:42:35 METRO: 180° behind you.  
How far behind?  
20:42:40 METRO: You are just running out of level 4, and if  
you do 90° - 270° and go right on back thru. The only  
thing I'm wondering about the altitude, whether we  
should go up or down and I don't have UHF, so be guided  
by your radar.  
20:43:00 The only thing we see reflectivity - wise is far below  
us. 31,000 ft.  
METRO: Just turn around, go right thru again. Maybe  
go a little further southwest this time.  
20:43:40 Data off.  
20:43:41 (AIS & DLite data off. Cloud exit. )  
In the turn I see yellow - probably go away in wings  
level.  
  
AIS Record 6 - Pen #5, FL310, 220°.  
  
20:46:38 Data on.  
20:46:41 Clear stormscope,  
20:46:49 Data on Pen #5, FL 310. Initial heading 220°.  
20:46:50 (AIS & DLite data on. Time code stable. Cloud entry.)  
20:47:06 Occasional light turbulence. No rain. Very bright.  
20:47:12 METRO: Moderate field mill activity.  
Going to come right. Try to pick up other stuff.  
This doesn't look like much here.  
20:47:28 Camera on. (External camera on.)  
20:47:58.2 (LeCroys 1-4 trigger.)  
5° down. (On tilt.)

20:48:06 Camera off. (External camera off.)  
20:48:20 I just lost all my radar.  
I still got it.  
20:48:23 Here it comes.  
Maybe we'll get something. Got a little yellow in it.  
20:48:47 Let's go camera on.  
20:48:48 Camera on. (External camera on.)  
20:49:09 Occasional light turbulence. No rain.  
Now going light to moderate turbulence and light rain.  
20:49:14 Nearby flash.  
20:49:23 Continuous light turbulence and light rain.  
20:49:30 (LeCroys 1-4 trigger, record first of two strikes.  
20:49:31 Nearby flash and triggers.  
20:49:33 A strike. I think following the triggers.  
20:49:38 Right side of the nose boom.  
20:49:40 I saw that - 2 in a row, I think.  
20:49:44 I saw that one on the right.  
20:49:49 Turn camera off. Starting 90° - 270°.  
20:49:53 Camera off. (External camera off.)  
20:49:57 METRO: When you run out this thing, just go right back.  
20:50:03 (AIS & DLite data off. Cloud exit.)  
20:50:05 Bring data systems off.  
We may penetrate during the turn right.  
SPANDAR: You've gone beyond our capability for color display for ... to give you any intensity back. Wanted to let you know.  
Cloud exit.  
These little bumps are probably some of the stuff I was seeing before.  
Breaking in and out of it, too.  
Weapons bay holding about 85°, which is acceptable.  
Nice yellow dot coming up.  
Looking about 2° nose down, so this one looks more promising.

AIS Record 7 - Pen #6, FL 310, 060.

20:52:46 Data system on - 4 green lights.  
20:52:50 (AIS & DLite data on. Time code stable. Cloud entry.)  
20:53:32 Camera on. (External camera on.)  
20:53:42 Data systems on for pen #6, FL 310, heading 060°.  
20:53:53 Continuous light rain and light turbulence and nearby flashes.  
20:54:00 METRO: Good field mill.  
20:54:05 Getting darker. Other conditions the same.  
20:54:08 That may have been a strike. If was real near.  
20:54:14 Very close flash. No triggers.  
20:54:16 METRO: Strong field mill.  
20:54:35 Rain has died off, but still in continuous light turbulence.  
20:54:45 Camera off. (External camera off.)  
20:54:55 (AIS & DLite data off. Cloud exit.)

20:54:57 Bring data off.  
SPANDAR: There's area of level 2, at you altitude.  
Due east of you about 5 miles. Little green dot.  
We'll probably hit this. It's about 5 miles.

AIS Record 8 - Pen #7, FL 310.

20:55:47 Data systems are on for Pen #7, FL 310.  
20:55:50 (AIS & DLite data on. Cloud entry.)  
20:55:54 Camera on. (External camera on.)  
Start left turn while doing this.  
20:56:00 Light rain and light turbulence.  
20:56:05 Good strike! Good strike! Left side.  
20:56:06 (LeCroys 1-4 trigger and record strike.)  
20:56:07 Direct strike on left side, 4 triggers.  
Nice and vivid.  
Didn't hear anything from that one.

20:56:25 Bad news for MARS, boys. The MARS tape recorder had  
stopped. (Circuit breaker pops in DLite circuits,  
killing 2 MARS tape recorders and cal. circuit.)

20:56:48 Metro, the MARS tape recorders are not running. Last  
strike we triggered and the tape recorder lights went  
out.

20:57:12 Camera off. (External camera off.)  
METRO: Try recycling (DLite) instrument power. See  
if that bring it back.

20:57:20 Will attempt to do so now.  
20:57:29 DLite instrumentation off.  
20:58:00 No joy on tape recorders. I recycled MARS tape switch  
and instrumentation power and can't get lights to come  
back.

20:58:48 I'll try it again.  
20:58:55 Instrumentation power off.  
20:59:00 Instrumentation power back on again.  
Trigger lights are with us.

20:59:08 No joy with tape recorders. I think we have lost them.  
20:59:35 METRO: Try master data switch which runs tape recorders.  
20:59:43 (AIS & DLite data off. Cloud exit.)  
Got some good return, headed for 15 miles away.  
I'll bring everything else on.

AIS Record 9 - Pen #8, FL 310.

21:00:07 Bill Bardens power back again.  
21:00:19 This is not the same cell we got struck in last time.  
I don't think.

21:00:20 (AIS & DLite data on. Time code stable. Cloud entry.)  
21:00:30 We're going to miss the cell to right. Turn camera on  
few moments.

21:00:38 You got camera. (External camera on.)  
21:01:04 In light turbulence.  
21:01:12 METRO: Any luck?

I recycled master data switch, still no joy on tape recorder. I attempted to recycle the MARS switch and no joy.

20:01:26 Camera off. (External camera off.)  
METRO: Try going thru complete power cycling sequence, all way to complete power off.  
We have to get out of clouds to do that because it will screw up radar.

21:01:50 METRO: If you want to get out of the cloud a turn to south or southwest.

21:02:02 Camera is on. (External camera on.)  
21:02:09 METRO: We have a little time to burn on it, so if you are willing to try that, we might just see if it works, otherwise it is RTB.

21:02:19 We are going to try finish this penetration and get outside and try recycle.

21:02:22 (LeCroys 1-4 trigger, but no DLite data. External camera records a direct strike.

21:02:23 Hey!  
I'm not sure if that were a strike or not- very close.  
It was a direct strike. All the triggers went off, but I've got no tape recorder lights. The movie camera was running.  
That was a good strike.

21:02:38 I blinked my eyes just about the time it happened. I didn't actually see the channel.

21:02:43 I did, also made the thump sound as well.

21:02:53 I'm going to start 90° - 270°. Why don't you start?

21:02:51 Camera is off. (External camera off.)  
Bring radar to standby.  
Instrumentation power is off.

21:03:00 (AIS data off.)  
21:03:02 DLite master power off.  
METRO: You get another strike, 816?  
Negative. I'm going thru complete cycle on DLite now.  
DLite master power is on.  
All test lights are good.  
DLite instrumentation is on. 4 good lights.  
As soon as you roll back out, we'll bring everthing up and see what happens.  
METRO: 816, check on tape counter to see if that is running?  
Any reason you can't bring it on in turn.  
No, bring radar up.  
Now, see if I can make this sucker run.  
We've lost MARS tape.  
What do we have?

AIS Record 10 - DLite Check.

21:04:40 (AIS data on.)  
21:04:48 You can get altitude, temps, field mills and movie camera.  
You can not get wave forms at all.  
21:05:03 (AIS data off.)  
Guess we better ask what he wants to do.

AIS Record 11 - Pen #9, FL 310, 110° -080°.

Metro, just went thru complete recycle. No joy on  
tape recorder on DLite.  
METRO: Could you tell if tape timer had advanced?  
It has not advanced. Frozen at 21 minutes.  
METRO: Unless you want to go out there and take pictures,  
you might as well come on home, and I don't see any  
value in pictures.  
We're about to commence a penetration to the east, then  
we'll RTB.  
21:06:05 Data on for penetration 8, FL 310.  
21:06:10 (AIS data on. Time code stable. Cloud entry.)  
21:07:14 Going to pick up yellow we're in, instead of going for  
little one.  
21:07:48 What did you do to it?  
21:07:54 I think I'm looking down so far I've blocked it out.  
I'll hold what I've got, see what happens. Then go home.  
Very well.  
21:08:30 Initial heading was 110°, now down to 080°.  
21:08:53 Camera on. (External camera on.)  
21:09:07 Occasional light turbulence. Very bright. No rain.  
21:09:14 Now we got rain.  
21:09:16 Light turbulence, light rain.  
21:09:58 That's it. Cut camera off and anything else off you  
want to.  
21:10:06 Camera off. (External camera off.)  
21:10:07 (AIS data off.)  
21:10:09 Data off.  
21:10:29 (Voice recorder off.)  
21:10:39 (Video recorder off.)  
21:11:04 (DLite instrumentation off.)  
21:11:23 (DLite master power off.)

AIS Record 12 - Burst.

(AIS data on. Time code unreadable.)  
(AIS data off. Time code unreadable.)

AIS Record 13 - Landing.

21:26:20 (AIS data on. External camera on.)  
21:27:46 (Landing.)  
21:28:32 (AIS data off.) (External camera out of film.)  
21:32:40 (AIS data on.)  
21:33:43 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-015 F-106B

Date May 27, 1984

Crew Brown/Fisher

Engine Start 20:03:16

Take-off 20:11:36

Landing 21:27:46

## Lightning Systems:

Dlite 5 Triggers

10ns LeCroy I.1  $\dot{J}_D$  2  $\dot{B}_{W,L}$  3 INOP

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1 INOP 2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

## Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video INOP

Voice OK

Kavouris Radar

Receiver NU

Aft movie camera 2 Strikes

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) PINOP.  $E_y$  intermittent.

X-Ray NI

Los Top TBD Aft NI

Fin Cap Type KT/EP. Strike damage.

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Elizabeth City,

NC.

Pens 9

Strikes 6

Nearbys 2

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 015

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OKKavouris System OKBasic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR NU - Too far.UHF Radar INOPC-Band Tracking OKGoddard Antennas GSFC NU - Too far.WFF NU - Too far.LaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK



Debrief Notes for Flight 84-016, May 28, 1984

Storm Flight/TAR River, VOR, N.C.

Neely/Winebarger

GMT

16:24:00

Engine start.

(AIS inoperative for this flight.)

Takeoff.

METRO: 816, we've had a request that you call the start and end of data runs and also label penetrations.

2° down tilt, 20 miles range. Nothing.

(Altitude 28,200 ft., Heading 227, OAT = -31°C.

Data is on.

Not in storm yet.

We're over it.

Tops on storm about 28,000 ft.

(16:54:52)

Entered cloud.

Be funny if we got stuck. I'll laugh my behind off.

Just skimming the top of it.

METRO: Going to try and go down, Bill?

Yeah. I want to go through this and look on the other side before I start down. It'll give me a chance to look around visually.

(16:55:32)

We're out the other side.

We got to go a lot lower.

We just went through that storm and as I look back at it, it's pretty wispy all the way down. I have another storm out here about 25 miles. That's the one I'm gonna go to. It looks to be higher and I'm going to descend some if I can.

METRO: What altitude will you go to?

I'm going to ask for 24,000.

A good day to get flying time even if you had to jump out. Have your pick of fields.

Range to home - 94.

METRO: Rog, check that both transmitter switches are on and enable switch also.

Both TM switches are on.

Data switch is on.

METRO: Make sure that our tape flows, in next run. We didn't see it down here.

It hasn't moved on counter here.

METRO: Make sure you got green light next time you turn tape on. We might get a penetration out of this mess.

METRO: Describe what you are seeing on your radar.

Got a green blob about 17 miles.

METRO: That's going to be your extreme range when you go through that one.

I see the storm here and if I go to the dot I go through little valley over there so I'm going to go through what I see as the storm. We got a little lenny over there. This might be a little bumpy.

Looks like we are getting closer to what the radar says.

Not much precipitation in this guy - some on the other side.

Here's 24,000 ft , trying to maintain 300.

Data on.

Data is on. Getting ready to penetrate a cloud.

Tilt way down.

Penetration 2.

(17:01:16) Cloud entry. Penetration #2. (AIS = 23,400, Heading = 241, OAT = -21°C.)

Turn cameras on.

Cameras on.

METRO: Are you showing data on AIS right now?

Affirmative.

METRO: We're showing some field mill activity.

We're just in the cloud that is real light turbulence. That's about it.

(17:01:56) We broke out.

Nothing here.

METRO: If you are through that cell I'd like you to do a 90°-270° and come back on a heading a little bit more easterly than you went through. There's a storm just south of Rocky Mount, I'd guess about 25-30 miles from your present position that is probably the biggest thing around on a heading 80°.

METRO: Are you starting your 90°-270° to come back?

I'm on heading of 085° right now and to be honest with you I don't see the storm you are talking about.

METRO: We'll talk about it after you get settled out on a heading 70-80 degrees, somewhere in there.

Sounds like that storm we came through on the way down here.

METRO: What do you see about 120° about 20 miles from you?

There's some puffy's but no storm. Maybe one that may be a storm later but no storm now.

METRO: Well the biggest thing we got going is to come back south of Rocky Mount on about a 70° heading and go through that. It's about 35 miles from you then go out of Rocky Mount storm on heading of about 20°.

OK. I'm heading almost direct to Tar River now - blocking 24 to 25 and don't really see that much right now.

Penetration 3.

17:05:02 Back in. Penetration #3. (Alt. = 23,900, Heading = 062, OAT = -23°C.)

17:05:23 We're out.

Any stormscope activity?

Not a thing.

How much lower can we go?

METRO: It's up to you. We'll lose communications I think. You're 127 out and if you're 24,000, you're at about .6 horizon and you can't go much lower and still keep communication. It looks like things are really slow. I don't know. It really looks unproductive unless you want some cloud penetrations.

17:06:12 METRO: I know what you are saying. We got there a little early I guess.

The hottest thing I see going - Well it just went away. We don't see many high tops around there. Why don't you drive on back on that heading, and take targets of opportunity and when you get across that river we'll decide what to do.

17:06:38 It looks like these things are coming up to 28-29,000 ft. and just stopping. There's no storm out here higher than about 28-29,000. That's top of the clouds. The storm is actually lower than that.

17:06:52 METRO: SPANDAR confirms that tops are around 28k now.

17:07:29 METRO: Do you see a target about 090° from you at about 10-15 miles?

17:07:36 Yeah, It's relatively ill defined but there is a storm there, rain shower type, cloud mass. It's not really a storm, just looks like a rain shower.

17:07:52 We're going to go through a little puffy here in about a mile then we'll turn and take a look.

#### Penetration 4.

17:07:57 We are in it. (Alt.=24,700, Hdg.=034, OAT=-23°.)

17:08:03 METRO: A little field mill activity.

17:08:07 We are out.

17:08:12 METRO: How about heading 090 and going over to that indistinct rain shower?

17:08:17 On my way.

17:08:37 METRO: If you don't get hit in this one I'd like you to come out and go due north, you'll spot the cell, I hope, when you get out. It will be about 30 miles north of you.

17:09:01 I'm going to have to get down to get in tops of this one.

17:10:14 Stormscope now?

17:10:15 Not a thing.

17:11:19 I'm going down to 200. We were in the clear at 24,000 way above it.

#### Penetration 5 (Alt 22,000 descending, Hdg 148°, OAT=-18°C.)

17:11:41 Cloud entry from the top.

17:12:08 Penetration #5.

17:12:17 Still no stormscope?

17:12:19 Not a thing.

17:12:31 We're out. (Altitude 20,200'.)

17:12:33 Smooth ride.

17:12:47 Metro, that was a smooth ride, clear, smooth air. I think we are wasting gas.

17:12:56 METRO: OK. Come around to heading about 10° and see if you can find that cell north of you.

6.4 gas.

17:15:07 METRO: What do you see on radar?  
17:15:08 Not much. Tell him what you see. Rog.  
17:15:14 He must have tilt way down because I've got a big swipe of green with a tunnel up the middle.  
17:15:24 About 2 down.  
17:15:30 There's a little spot of yellow out there at 35 miles.  
17:15:37 METRO: 12 o'clock.  
17:15:39 About 11.  
17:15:41 METRO: That's it. If that don't do it we'll decide what to do after you come through it.  
17:17:05 Shall I go for clouds or go for dot?  
17:17:10 Go for dot.  
17:19:13 Turn cameras on.  
17:19:32 METRO: We think the best thing is about 030° from your present heading. I think you may as well come home, park it and wait for it to build up.  
17:19:50 I'm not going this far and not go through the dot.  
17:20:00 METRO: You copy?  
17:20:02 Yes, we're going through this green dot.  
17:20:30 I brought cameras on just now.  
17:20:35 I wish we had the polaroid today. Show Norm what we are looking at.

Penetration 6. (Alt.-18,800, Hdg.-339, OAT--11.)

17:20:45 Cloud entry.  
17:20:48 Biggest bumps today.  
17:20:50 This is the most bumps we've had.  
17:20:54 No precipitation - yep, little bit.  
17:21:00 Little bit precipitation.  
17:21:04 We're out.  
17:21:08 METRO: If you can do a hard right, 90° there's a little cell over there then come home.  
17:22:47 Metro, we're coming home. 60 miles.  
17:23:03 METRO: At your 9 o'clock position - starting to show a level 3 - about 15 miles.  
17:23:09 That's pretty low stuff.  
17:23:17 Very small. Can't be more than a mile in diameter.  
17:23:23 METRO: I sorta agree.  
17:23:28 Looks like big stuff is out over the mountains.  
17:23:43 Want a DLite cal?  
17:29:49 METRO: Might as well.

Landing.

17:38:03 Touchdown

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-016 F-106B

Engine Start 16:24:00

Date May 28, 1984

Take-off 16:42:08

Crew Neely/Winebarger

Landing 17:38:03

Lightning Systems:

Non-Lightning Systems:

Dlite 0 Triggers

AIS INOP \*\*

10ns LeCroy I.1  $\overset{\cdot}{D}_F$  2  $\overset{\cdot}{B}_{W,L}$  3 INOP

INS INOP

10ns LeCroy II.1  $\overset{\cdot}{D}_T$  2  $\overset{\cdot}{I}$  3  $\overset{\cdot}{B}_L$

Telemetry:Top INOP

10ns LeCroy III.1  $\overset{\cdot}{D}_{W,R}$  2  $\overset{\cdot}{D}_{W,L}$  3  $\overset{\cdot}{D}_F$

Bottom OK

10ns LeCroy IV.1 TP101 2  $\overset{\cdot}{I}_N$  3  $\overset{\cdot}{I}_T$

Airborne Radar: Fwd OK

Digital Peak Counter 1  $\overset{\cdot}{I}$  INOP 2  $\overset{\cdot}{D}_F$  INOP

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Aft movie camera NU

Kavouris Radar

Cockpit cameras NI

Receiver OK

Stereo Fwd

**\*\* Screw backed out reel.  
C/B popped.**

Hass aft

Aft video

Field Mills (4) FM Only

Region Tar River VOR, NC

X-Ray NI

Los Top TBD Aft NI

Pens 6

Fin Cap Type KT/EP

Strikes 0

Passive protection

Nearbys 0

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-016

## Ground-Based

Metro

## Telemetry

Strip Charts OK

PCM Data OK

## Kavouris System

Basic Display OK

INS Overlay OK

Triggers OK

Videotape OK

Satellite Pictures OK

Wallops

SPANDAR OK

Videotape OK

Digital dBZ Tape OK

LDAR INOP

UHF Radar INOP

C-Band Tracking OK

Goddard Antennas OK

GSFC NU

WFF OK

LaRC NI

ELF Antenna NI

LLP OK

WFF Plots OK

LaRC Plots INOP

WFF Tape OK

Debrief Notes for Flight 84-017, May 28, 1984

Storm Flight/West Point, VA to Patuxent, MD

Neely/Winebarger

GMT

19:48:40 Engine start.

AIS Record 1 - Takeoff.

19:56:40 (AIS data on.)

19:57:03 (Liftoff.)

19:57:41 (AIS data off.)

(20:07:41) SPANDAR: The level 3 is about 135° from you, 15 miles.

(20:07:46) 5 down on tilt coming up 280, heading 043°, 290 a/s.

(20:08:01) Storm is 2 miles away.

AIS Record 2 - Penetration #1.

(20:08:10) (Data on.)

(20:08:11) Camera on.

20:08:15 (Event - storm entry.)

(20:08:20) Just entered the cloud.

(20:08:44) My scope is blank. 5 down.

(20:08:53) Think we saw a distant flash.

(20:09:01) Some precipitation.

(20:09:07) Why don't you send a Kouvaris and blow it up so I can see where I am, please.

(20:09:28) Few moderate bumps.

20:09:43 (Event - storm exit.)

(20:09:44) We're out.

(20:09:50) (Data off.)

(20:09:53) Not much in that guy. Go through this one see what happens.

(20:09:58) Camera off.

Off.

(20:10:06) Stormscope say anything?

(20:10:09) No.

(20:10:10) What I'll do - I'll go in this guy, hang a right - go out there and come back through that one if they'll let us.

(20:10:30) We're 44 miles NE Richmond and heading north.

(20:10:48) METRO: You should have a 60 Patuxent picture.

(20:11:03) See all the lightning around there? I think we ought to go low.

(20:11:11) METRO: Think it would be better to go higher?

(20:11:15) No, we'd be out of the tops.

(20:11:19) We're scooting along about 3,000 ft. below the top now.

(20:11:23) How about low?

(20:11:24) METRO: Hold that altitude and go dead south of where you are.  
There's 2 cells lined up.  
(20:11:36) I'm gonna turn right about 90°, starting right now, to get into  
this one.  
(20:11:48) METRO: What heading are you going to go in?  
(20:11:52) About 090°.

## AIS Record 3 - Penetration #2.

20:12:00 (Data on.)  
20:12:04 (Event - storm entry.)  
(20:12:05) Camera on.  
(20:12:06) We're in the cloud.  
(20:12:15) Leveled off at 060°.  
20:13:00 (Data off.)  
(20:13:03) METRO: We don't see any lightning in that area. That cell that  
you are in, just left of Patuxent. I'd like you to go back down  
south.  
(20:13:14) In right turn now.  
(20:13:59) METRO: If you come out of Patuxent on a 210° radial - about 25  
miles from your present position, you'll enter the first cell,  
then I want you to pick up heading of about 180°.  
(20:14:31) Make a left turn - go on through that cell - go on south another  
30 miles.  
(20:15:22) METRO: Do you see the target storm about 15 miles ahead of you?  
(20:15:28) We see it. See that little green dot?  
Yeah.  
(20:15:32) We've got just a spot of green at 15 miles.  
(20:15:37) METRO: Then another 15 miles beyond that, a slight left turn,  
there's another cell.  
(20:15:44) We got that.  
(20:15:47) I'm looking at 5 down on tilt, 15 miles away and it just  
disappears. 283.  
(20:16:18) METRO: Probably looking through the cables.

## AIS Record 4 Penetration 3.

20:16:50 (Data on.)  
(20:17:05) Camera on.  
(20:17:08) METRO: We show you about cloud entry.  
20:17:11 (Event - storm entry.)  
(20:17:11) You called it.  
920:17:24) Getting a little bit of bumpy ride in this one.  
(20:17:31) Little bit of rain.  
20:17:40 (Aft camera recorded strike.)  
(20:17:40) Strike!  
Hurray!  
(20:17:44) No triggers.



(20:17:49) METRO: We see that too.  
(20:18:00) That one was audible.  
(20:18:24) Want us to go back through or go to next one?  
(20:18:29) METRO: Go back where we got hit.  
20:18:36 (Event - storm exit.)  
20:18:44 (Data off.)  
20:19:49 METRO: Zaeph1 wants you to try Cal sequence in a hurry.

## AIS Record 5 - Penetration #4 and DLite Cals.

20:20:00 (Data on.)  
(20:20:02) Try it.  
(20:20:05) They went.  
(20:20:23) Light precipitation and light turbulence when we got that strike.  
(20:21:05) That's better. More defined.  
(20:21:27) 33 miles from Patuxent.  
(Event - storm entry.)  
(20:21:32) What's going on?  
I calibrated.....  
(20:21:46) Now we are OK.  
20:21:56 We are back in the cloud. That was a cal on the triggers, for a good cal.  
20:22:04 We're in storm. Cameras on?  
20:22:07 On.  
20:22:16 Airspeed up to about 330 now, heading 030°, 282 altitude.  
20:22:26 Getting precipitation.  
20:22:52 (Event - storm exit.)  
20:22:53 We're out.  
20:22:59 (Data off.)  
20:23:02 METRO: I'd like you to do a 90° - 270° but set up on a heading of 190° and go through both cells. The one you just did and one about 15 south.

## AIS Record 6 - Penetration #5.

20:25:20 (Data on.)  
20:25:21 METRO: Just got 2 cloud to ground about 15 ahead of you.  
20:25:24 (Event - storm entry.)  
20:25:26 We're in the cloud. Penetration 5.  
20:25:32 Camera on.  
20:25:37 Say the range to next storm.  
20:25:43 METRO: About 15 n. miles, 12 o'clock.  
20:25:49 Light precipitation.  
20:25:51 Distant flash.  
20:25:27 Another distant flash.  
20:25:59 175° heading.  
20:26:27 METRO: I show you having just exited the first cell. I want you to go on to the 2nd cell. If we don't get hit up there, why don't we go down to 15,000 and come

Back up there that cell on a reciprocal heading? Can you work that? We'll try a low altitude and see what the field mills show.

20:26:57 We are still in the cloud.

20:27:00 METRO: I suspect you are. You are out of the level 3 and George just advised a little bit of level 5 in the one you are in.

20:27:20 METRO: You still have data on?

20:27:22 Affirmative.

20:27:24 METRO: Say weapons bay temp.

20:27:26 85°.

20:27:31 Camera off.

20:27:33 (Event - cell exit.)

20:27:54 METRO: We show you just a couple of miles away from the next interesting cell.

20:28:00 Got tilt about 10 down, Barely can see it.

20:28:05 (Event - 2nd cell entry.)

20:28:07 We're in it. Camera on.

20:28:17 Some rain.

10:28:57 (Event - cell exit.)

20:29:22 Cameras off.

20:29:24 Nope.

20:29:25 (Data off.)

20:32:00 There's nothing on right side of scope.

## AIS Record 7 - Pen #6.

20:33:20 (Data on.)

20:33:22 (Event - storm entry.)

20:33:25 We just entered a cloud but we got a ways to go to hit contour on radar.

20:33:40 METRO: The storm of interest now bears about 170° from your present position.

20:34:51 Getting a few bumps here.

20:35:09.1 (All LeCroys triggered.)

20:35:10 We just got srtuck!

10:35:11 We just took a strike.

20:35:14 We Just took a strike while you were talking.

20:35:36 METRO: I'd like you to do a 180° and go back thru that one and go on down to the one south.

20:35:36 (Event - storm exit.)

20:35:43 (Data off.)

20:37:16 Range and bearing now to storm

20:37:33 METRO: We'd like you to head about 190° and it will be about 35 miles.

## AIS Record 8 - Pen #7 &amp; #8.

20:39:27 (Event - storm entry.)

20:39:30 (Data on.)

Enter storm for Pen 7.

20:39:48 Tilt is 2 down.  
20:39:54 METRO: Come left to about 190° or 185°. I think  
you'll find the target storm about 25 miles ahead of you. 20.  
20:40:27 METRO: I'd like you to make left turn to 180 °.  
20:40:32 We're turning.  
20:41:26 5 down or tilt.  
20:42:02 25,000 ft.  
20:42:10 5 miles away.  
20:42:20 Camera on.  
20:42:25 I hope we get struck. Make Norm feel good about working  
and getting us in this storm.

Pen #8.

20:42:45 We should be in your storm now. It disappeared from  
our radar before we got to it.  
20:42:51 METRO: You above it?  
20:42:54 We're in it.  
20:42:57 METRO: We see it on the field mill.  
20:43:02 Some light precip, some light turbulence.  
20:43:05 That was about it.  
20:44:04 Camera off.  
20:44:10 How about a Kavoris?  
20:44:19 METRO: We'll attempt to get you a Kavoris. The storm  
you just went thru is the best in the immediate neigh-  
borhood, if you could go back thru that. Go lower,  
higher or something.  
20:44:32 I'm trying. The guy is so busy I'm stuck here.  
20:45:06 Roll out and see what the world looks like.  
20:45:14 Looks like you might as well take a little green  
one there at 7 miles.  
20:45:48 METRO: You are cleared to 15,000 ?  
20:45:50 That's right.  
20:45:59 We're back in another little cell here.  
20:46:20 Few flashes.  
20:46:25 METRO: Weapons bay temp?  
20:46:29 92°  
20:46:35 (Data off.)  
METRO: Pen 8?  
20:46:38 Affirmative.  
20:46:50 METRO: I see another cell setting up at about your -  
310° from you at about 40 - 35 miles.  
20:47:03 That's out in the clear. We can see it. It is not  
worth going to. We got one dead ahead at 17 miles.  
20:47:29 METRO: I was mistaken at your position. It's more  
like 270° from you at about 25-30 miles.

AIS Record 9 - Pen #9.

20:47:30 (Data on.)  
20:47:38 We could see that and it didn't look like much, from

here, when we were in the clear.  
20:47:44 METRO: The absolutely hottest thing is a level 4. 15 miles north of Patuxent. Put it about your 12 o'clock position, 30 miles.  
20:48:45 We got some yellow ahead of us now.  
20:48:49 METRO: How far?  
20:48:51 7 miles.  
20:49:00 We're in leading edge of that storm.  
20:49:01 (Event - storm entry.)  
20:49:13 Camera on.  
20:49:23 Pen 9.  
20:49:38 Heavy rain.  
20:49:52 SPANDAR: Northwest your position, 3 miles, small area level 5, 15,000 altitude.  
20:49:53 (Event - storm exit.)  
20:50:03 That's our altitude.)  
20:50:07 SPANDAR: Roger. You are skirting eastern edge of it.  
20:50:21 Norm. We see the storm you are talking about. It's about 340° - 350° at 15 miles.  
20:50:24 (Data off.)  
20:50:28 METRO: Affirmative.  
20:50:30 We are on the way.  
20:50:57 Got storm dead ahead 12 miles.  
20:51:00 Weapons bay is 95°.  
20:51:19 78 miles from home, 15,000 ft.

## AIS Record 10 - Penetration 10.

20:51:30 (Data on.)  
20:51:43 Stormscope?  
20:51:46 Nothing.  
20:51:53 Essentially level radar. Will put exactly level.  
20:51:59 Spot of yellow, at 15,000 ft, 300 kts. Storm is coming inside 10. Darker.  
20:52:10 Camera on.  
20:52:44 (Event - storm entry.)  
20:52:44 METRO: Following this penetration go back to Patuxent and go out on 190° radial back to that storm on the Rappahanock.  
20:53:07 We're just about ready to enter some yellow.  
20:53:12 Some of these spots are red. Coming right a little bit.  
Lots of red.  
20:53:18 Suddenly red appeared in it.  
20:53:26 Rain. Heavy rain.  
20:53:36 816, SPANDAR shows level 4 dead ahead 2 miles.  
20:53:42 We just went through it.  
20:53:44 (Event - storm exit.)  
20:53:53 (Data off.)  
20:54:18 METRO: On your departure from Patuxent I'd like you to maintain 190° heading.

20:54:50        Pretty good storm.  
20:55:08        I'll bet there's yellow between those 2, but not being picked up  
                 because of the dome.

## AIS Record 11 - Penetration #11.

20:55:20        (Data on.)  
20:55:24        Data is on.  
20:55:38        (Event - storm entry.)  
20:55:39        No red this time. Notice that?  
20:55:42        We are back in heavy rain.  
20:55:52        Any stormscope?  
20:55:54        No.  
20:55:55        That storm was softer that time.  
20:56:26        Weapons bay is a 100°.  
20:56:32        METRO: Better shut it down and climb.  
20:56:36        Huh. How about just shut it down?  
                 You really want to climb?  
20:56:41        Let's just shut it down.  
20:56:47        (Data off.)  
20:56:52        METRO: Alright your choice on altitude but I'd like to go back  
                 to Patuxent and come out of it on a 190° heading.  
20:57:00        Turned off.  
20:57:41        METRO: Keep us advised of temperature if it falls off.  
20:57:53        There is a lag in that weapons bay temperature.  
20:57:54        SPANDAR: Level 5 at seven miles.  
20:58:04        We're 7 miles to storm. Want us to bring it back on and go  
                 through.  
20:58:11        METRO: No, I don't want to turn it on.  
20:58:21        It has an over temperature light on the panel that hasn't come on  
                 yet.  
20:58:27        METRO: Look, you are 30 or so miles to the storm I want to get  
                 you in next, if you could climb quickly it might cool enough that  
                 we could turn it on by the time you get down there.  
21:00:02        Is the next storm 12 o'clock, 25 miles?  
21:00:06        METRO: That's about it.  
21:02:02        What's temperature?  
21:02:04        A shade under a 100°. Just starting to drop.  
21:02:15        METRO: Say weapons bay temperature.  
21:02:18        Just barely under 100°.  
21:02:51        METRO: I show you approaching the cell. Just before you enter  
                 the cell go ahead and turn on the DLite and turn off when it gets  
                 100° or the other side.  
21:03:06        I'm looking pretty close to a BINGO. I'm 3,500 now.

## AIS Record 12 - Penetration #12.

21:03:10 (Data on.)  
21:03:16 We are looking at it for you. There is another cell  
between you and here but it's a target possibility.  
21:03:27 METRO: Is DLite on now?  
21:03:29 It's on.  
21:04:06 (Event - storm exit.)  
21:04:08 (Data off.)  
21:04:12 METRO: I show you out of the area. Do you show  
another cell about 20 miles at 1230?  
21:04:20 Roger- that's where I'm going.  
21:04:24 METRO: That would be good. Get you close to home  
and with DLite off maybe it will cool some and we  
can get some data in there.  
21:04:41 It's about 98° now.  
21:05:50 METRO: Are you in the clear now?  
21:05:51 Roger that.  
21:05:55 METRO: What does the cell look like visually?  
21:05:59 A lot of tall puffy.  
21:06:00 METRO: Did it go above you?  
21:06:04 Not far.  
21:06:24 The pilot estimates maybe 31-32,000.  
21:07:14 Looks like the best storms around are right around your  
house.  
21:07:20 METRO: OK. You got enough gas - go for then.  
21:07:51 Bring data on for this.  
21:07:54 This may be a storm.

AIS Record 13 - Pen #13.

21:08:25 (Data on.)  
21:08:25 We're back in what we were looking at from a distance.  
It doesn't show on the radar now.  
21:09:00 Flashes.  
21:09:21 METRO: You getting flashes?  
21:09:23 One flash there about 30 seconds ago.  
21:09:27 METRO: We show it.  
21:09:32 We got one out here about 17 miles. That's about 3 miles  
wide and mile deep.  
21:09:45 Looks like it may be some storm.  
21:09:56 (Event - storm exit.)  
21:10:02 (Data off.)  
21:10:08 What's your winds on surface there?  
21:10:33 We're right over idle fleet.  
21:10:37 METRO: We show a level 4, 12 o'clock about 8 miles.  
21:10:44 That's where we are going.  
21:10:46 Surface winds 190 @ 8 to 12, gust to 20.  
21:10:58 METRO: Yeah - if it moves east... It will get us.  
21:11:03 I think what I'm going to do - I'm down to 4,000,  
I'm going to go thru this. If I don't get struck  
I'll RTB.  
21:11:19 METRO: Weapon bay?

21:11:21 95°.  
21:11:24 METRO: Want to cut it on.  
21:11:29 METRO: Advise when data on.  
21:11:32 Turning data on now.  
21:11:39 2½ miles away, 5° down on tilt.

AIS Record 14 - Pen 14.

21:11:40 (Data on.)  
21:11:51 We're in.  
21:11:57 Camera on.  
21:12:00 Almost out of it.  
21:12:19 Not much here.  
21:12:23 I'm going to RTB.  
21:12:53 (Event - storm exit.)  
21:13:32 (Data off.)

AIS Record 15 - Landing.

21:27:00 (AIS data on.)  
21:27:41 (Touchdown.)  
21:28:19 (AIS data off.)

AIS Record 16 - Chocks.

21:30:10 (Data on.)  
21:30:46 (Data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-017 F-106B

Date May 28, 1984

Crew Neely/Winebarger

Engine Start 19:48:40

Take-off 19:57:03

Landing 21:27:41

## Lightning Systems:

Dlite 1 Trigger  
10ns LeCroy I.1  $\dot{D}_F$  2  $\dot{B}_{W,L}$  3 INOP  
10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$   
10ns LeCroy III.1 INOP 2  $\dot{D}_{W,L}$  3  $\dot{D}_F$   
10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$   
Digital Peak Counter 1  $\dot{I}$  INOP 2  $\dot{D}_F$  INOP

Aft movie camera 1 Strike  
Cockpit cameras NI  
Stereo Fwd \_\_\_\_\_  
Hass aft \_\_\_\_\_  
Aft video \_\_\_\_\_  
Field Mills (4) OK  
X-Ray NI  
Los Top TBD Aft NI  
Fin Cap Type KT/EP  
Passive protection \_\_\_\_\_  
Diverter strips OK  
Wire mesh OK  
Stormscope Aft OK 0.5 OK

## Non-Lightning Systems:

AIS OK  
INS OK  
Telemetry: Top INOP  
Bottom OK  
Airborne Radar: Fwd OK  
Aft OK 0-5 OK  
C-Band Beacon OK  
Airborne Radar Video OK  
Voice OK  
Kavouris Radar  
Receiver OK  
Region West Point, VA to  
Patuxent, MD  
Pens 14  
Strikes 2  
Nearbys 0



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 017

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ OK \_\_\_\_\_

LDAR \_\_\_\_\_ INOP \_\_\_\_\_

UHF Radar \_\_\_\_\_ INOP \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ OK \_\_\_\_\_

LaRC \_\_\_\_\_ NI \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NI \_\_\_\_\_

LLP \_\_\_\_\_ OK \_\_\_\_\_

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ INOP \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

Debrief Notes for Flight 84-018, May 29, 1984

Storm Flight/Norfolk, VA

Brown/Fisher

GMT

19:38:36 (Engine start.)  
19:42:00 (DLite master power on.)

AIS record 1 - Takeoff.

20:00:20 (AIS data on.)  
20:01:30 (Takeoff.)  
20:02:11 (AIS data off.)

20:03:07 (DLite instrumentation on.)

AIS record 2 - Climb through clouds.

20:04:30 (AIS data on.)  
20:05:10 (AIS data off.)

20:06:25 (Voice recorder on.)  
20:06:36 (Video recorder on.)  
20:06:48 Voice and video recorders now on.  
20:07:27 METRO: I think you ought to steer a little bit to right.  
20:07:31 I concur.  
20:07:36 I still don't see too much out there.  
20:07:38 Nope, and I'm looking down 3°.

AIS record 3 - Penetration #1, FL230 - FL260, 120°.

20:08:17 Camera on. (External camera on.)  
20:08:24 FL230. 120°.  
20:08:30 (AIS and DLite data on. Cloud entry.)  
20:08:46 Data systems are on. Penetration #1, heading 120°, Departing  
FL230 for 260.  
20:08:54 Turn camera off, we are through it.  
20:08:57 Metro, we are through that cell. That was tiny. You have any-  
thing else out there?  
20:09:01 METRO: That's the one. We want you to keep going back and forth  
on that one.  
20:09:20 Bring all data off now.  
20:09:21 (AIS and DLite data off. Cloud exit.)  
  
20:09:39 METRO: We had some pretty good field mill on that, just  
before you broke out.  
20:09:45 METRO: Did you see any lightning?  
20:09:47 Negative, and it was very bright inside so we might not  
have seen distant flashes.

20:09:54 METRO: I show you went along the north edge of storm.  
20:10:00 That's not really right. We were just barely in the storm  
on the south edge.  
20:10:06 METRO: I understand.  
20:10:19 Can see it.  
20:10:23 Not very tall, though.  
20:10:25 Not very crisp-looking, either.  
20:11:49 METRO: I think the penetration heading has got to bend  
around to southwest from your present position.  
20:11:55 That's not what we see on our airborne radar.

AIS record 4 - Penetration #2, FL260, 260°.

20:12:01 Data systems on.  
20:12:10 (AIS and DLite data on. Cloud entry .)  
20:12:13 Camera is on. (External camera on.)  
20:12:15 Data on - Penetration #2, FL260, heading 260°.  
Data on at cloud entry.  
20:12:24 Very bright, occassional and light rain, Continuous light turbulence.  
20:12:36 Getting extremely bright.  
20:12:38 Break out above.  
20:12:39 Turn camera off.  
20:12:43 Camera off. (External camera off.)  
20:12:49 Weapons bay = 85°.  
20:13:02 Event for cloud exit. (Event.)  
20:13:17 Bring everything off. (AIS and DLite data off.)  
  
20:13:26 Data systems off.  
20:15:19 Not very impressive visually. In fact, I think it is falling  
down.  
20:15:25 Estimate maybe 30,000 tops.  
20:15:35 See some green and yellow about 30 miles to right.

AIS record 5 - Penetration #3, FL260, 070°.

20:15:54 You got your camera. (External camera on.)  
20:16:00 Data systems coming on at cloud entry for pen #3, FL260, 070°  
occassional light turbulence.  
(AIS and DLite data on. Cloud entry.  
20:16:26 Occassional light rain.  
20:16:42 Cloud exit - Event.  
20:16:44 (Event for cloud exit.)  
20:16:50 Camera off. (External camera off.)  
20:16:51 Data off. (AIS and DLite data off.)  
  
20:16:53 Did you get any field mill activity, Metro?  
20:16:58 METRO: We had real good Ex field mill at-surprised nothing  
happened. Like to do it again. YOur altitude is 26. Just  
stay there.  
20:19:09 SPANDAR: We have a small area of level 5, bearing 225° from  
you about 15 miles.  
20:19:16 We're painting that area on scope.  
20:19:49 Looking down 5°.

20:19:54 Couple small cells 5 miles ahead.  
20:20:06 Go ahead bring data on.

AIS record 6 - Penetration #4, FL260, 255°.

20:20:17 Data on for penetration #4. FL260, heading 250°.  
4 green lights.  
20:20:20 (AIS and DLite data on. Time code stable.)  
20:20:31 That stuff's nothing.  
20:20:34 Maybe main mass is still ahead of us.  
20:20:37 We're on edge of it. Either that, or it's beyond this cloud  
that's towering over us.  
20:20:48 Very tenuous.  
20:20:53 That's it? This little thing we're getting ready to fly into?  
20:21:04 Camera on. (External camera on. Event for cloud entry.)  
20:21:05 Event at cloud entry.  
20:21:09 Cloud entry. Continuous light turbulence.  
20:21:13 Good moderate bounce, and turbulence stops.  
20:21:23 Camera off. (External camera off.)  
20:21:26 Event for cloud exit. (Event.)  
20:21:31 Data off. (AIS and DLite data off.)  
  
20:21:34 METRO: We had some pretty sharp field mill excursions on  
that. Did you see any flashes?  
20:21:42 No flashes seen.  
20:21:46 METRO: How close to top do you think you are?  
20:21:51 The part we penetrated I don't think it goes more than another  
3,000 ft. above us.  
20:21:56 METRO: Was it very bright inside?  
20:21:58 It was extremely bright inside.  
20:22:02 Where we are seeing the most reflectivity is not the brightest  
part of the cloud. The part that we flew through is only about  
3,000 ft above us. There is a taller dome part that doesn't  
show as much reflectivity that maybe goes up another 6-8,000 ft.  
above us.  
20:22:21 METRO: Could we get over into that part of it ? It might  
be sort of a baby anvil.  
20:22:26 I'll try it this time.  
20:22:36 We've got the block 25 to 27, we're still at 26.  
20:24:02 Looking down 5°. I'm going at highest part of cloud, but reflect-  
tivity is off to right.  
20:24:11 What there is of it.  
20:24:19 Stormscope is almost zero.

AIS record 7 - Penetration #5, FL260, 060°.

20:24:42 Data on for penetration #5, 060° FL260.  
20:24:50 (AIS and DLite data on.)  
20:24:56 Camera on. (External camera on.)  
20:24:57 Event for cloud entry. (Event.)  
20:25:11 Now into continuous light turbulence.  
20:25:14 METRO: Field mill!  
20:25:16 Nearby flash.  
20:25:18 I saw a flash that time.  
20:25:27 I don't see any rain, though.  
20:25:29 METRO: ...Very active!

20:25:35 Calm and dry.  
20:25:44 METRO: I'd like you to do a 90° - 270°, and go back through that. We had a lot of Ex field mill.  
20:25:50 Well, we are still in it.  
20:25:52 Now we're out.  
20:25:55 Cloud exit with event. (Event)  
20:26:00 (AIS and DLite data off.)

20:26:02 All data off.

AIS record 8 - Penetration #6, FL260, 230°.

20:28:34 Data on.  
20:28:36 Camera on. (External camera on.)  
20:28:42 Camera off. (External camera off.)  
20:28:50 (AIS and DLite data on. Time code stable.)  
20:28:58 METRO: Field mills are starting to come alive.  
(Event for cloud entry.)  
20:29:01 Cloud entry.  
20:29:04 Penetration #6, FL260, heading 230° at entry  
20:29:11 Calm and dry so far.  
20:29:17 Camera on. (External camera on.)  
20:29:24 Occassional light turbulence.  
20:29:42 Light rain.  
20:29:44 Occassional light turbulence and light rain.  
20:29:51 METRO: Did you get a nearby?  
20:29:55 We got a big burst of something on the Stormscope, but no triggers and not visually seen.  
20:30:07 Cloud exit  
20:30:09 Event. (Event for cloud exit.)  
20:30:16 METRO: Those field mill excursions look real interesting.  
I'd like you to go back in.  
20:30:17 (All data off.)

20:31:12 METRO: We've started getting a little bit of light rain, and it looks fairly dark to southwest. I think that's the one you are going through. The one coming up is not nearly the storm that is.  
20:31:23 What's the weather underneath the storm we penetrated?  
20:31:30 I'd say, looking out to southwest, it's down to practically nothing.  
20:32:16 Negative 5' on tilt and what I had just went out of sight.

AIS record 9 - Penetration #7, FL260, 020°.

20:32:42 Data on for penetration #7 FL 260, heading 020°.  
20:32:50 (AIS and DLite data on.)  
20:32:54 (Event for cloud entry.)  
20:32:57 Camera on. (External camera on.)  
20:32:59 Cloud entry, event.  
20:33:02 Continuous light turbulence.  
20:33:05 And light rain.  
20:33:09 METRO: Very good Ex  
20:33:14 METRO: You see a nearby?

20:33:16 No, but I heard a click. No triggers.  
20:33:26 Conditions unchanged.  
20:33:54 Camera off. (External camera off.)  
9 miles from Langley.  
20:34:11 Cloud exit and event.  
20:34:12 (Event for cloud exit.)  
20:34:17 Data off. (AIS and DLite data off.)  
  
20:34:32 METRO: We can go through this thing back to southwest once  
more, then back up to northeast, then we'll have to RTB.  
20:34:39 METRO: I concur. That's about 10 minutes.  
20:36:11 -5° on tilt.  
20:36:13 Small cell about 11 out.  
20:36:18 Showing some yellow now.  
20:36:23 In the soup.  
  
AIS record 10 - Penetration #8, FL260, 200°.  
  
20:36:51 Data on.  
20:36:55 Camera on. (External camera on.)  
20:37:06 Data systems on for Penetration #8. FL260, heading 200°.  
20:37:10 (AIS and DLite data on. Time code stable. Cloud entry .)  
20:37:16 (Clear Stormscope.)  
20:37:38 Nearby flash.  
20:37:42 METRO: We see it.  
20:37:47 Occassional light turbulence, Almost no rain.  
20:37:57 METRO: Nearby?  
20:37:59 Not seen.  
20:38:03 Light rain and light turbulence-continuous.  
20:38:08 METRO: Ex is all over the place.  
20:38:12 Cloud exit.  
20:38:14 (Event for cloud exit.)  
20:38:21 Camera off. (External camera off. (AIS and DLite data off.)  
  
20:38:23 Other data off.  
20:38:30 Textbook exit conditions this side of the storm.  
20:40:40 SPANDAR: I see a level 3 and just a small area of level 4  
dead ahead about 5 miles.  
  
AIS record 11 - Penetration #9, FL260, 015°.  
  
20:41:12 Data on Penetration #9. FL260, heading 015°.  
20:41:20 (AIS and DLite data on. Time code stable.)  
20:41:27 Camera on. (External camera on.)  
20:41:28 Event cloud entry. (Event.)  
20:41:32 Cloud entry. Immediate light turbulence continuous.  
20:41:36 Lots of nearby flashes.  
20:41:41 Light rain. Continuous light turbulence.  
20:41:44 METRO: Wild field mills.  
20:41:50 Conditions unchanged.  
20:42:05 Turbulence and rain dying off.  
20:42:26 METRO: We see a cell 10 miles ahead on 090°.  
20:42:33 It's late for that now, Norm.  
20:42:38 Camera off. (External camera off.)

20:43:00 Nearby flash.  
20:43:07 We're coming out.  
20:43:09 Cloud exit, event. (Event.)  
20:43:13 (AIS and DLite data off.)

20:43:14 Data off.  
20:43:18 DLite cal next.

AIS record 12 - DLite cal, cloud mass, DLite cal.

20:43:21 Data on.  
20:43:30 (AIS and DLite data on. Time code stable.)  
20:43:35 METRO: If you can hold off on CALs, there's a cell you are  
going to fly through in about 3 miles.  
(DLite cal.)  
20:43:44 Well, I just CAL'ed it. I don't see it, do you?  
20:43:45 No, its below us, if it's there. It's below FL250.  
20:44:03 10° nose down on tilt.  
20:44:59 We're right on top of whatever this is. Must be the cell  
Norm called.  
20:45:04 We're not even in it.  
20:45:20 Going to recalibrate.  
(DLite cal.)  
20:46:23 (AIS and DLite data off.)  
  
20:46:40 (Voice recorder off.)  
20:46:47 (Video recorder off.)  
20:49:49 (DLite instrumentation off.)  
20:50:24 (DLite master power off.)  
(External camera on.)

AIS record 13 - Landing.

20:57:00 (AIS data on.)  
20:58:08 (Landing.)  
20:58:57 (AIS data off.)

AIS record 14 - Chocks.

21:01:20 (AIS data on.)  
21:02:14 (AIS data off.)

(External camera off with film remaining.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 018 F-106B

Engine Start 19 :38 :36

Date May 29, 1984

Take-off 20 :01 :30

Crew Brown/Fisher

Landing 20 :58 :08

Lightning Systems:

Dlite 0 Triggers

10ns LeCroy I.1  $\dot{D}_F$  2  $\dot{B}_{W,L}$  3 INOP

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP1012  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I}=0$  2  $\dot{D}_F=0$

Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera NG. Overexposed

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) PINOP.<sup>E</sup> intermittent.

X-Ray NI

Los Top TBD Aft NI

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Norfolk, VA

Pens 9

Strikes 0

Nearbys 0



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 018

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar INOPC-Band Tracking OKGoddard Antennas GSFC NUWFF OKLaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots INOPWFF Tape OK

Debrief Notes for Flight 84-019, June 5, 1984

Storm Flight/Luray, Va.

Neely/Winebarger

GMT

AIS Record 7 - Take off.

20:56:40 (AIS data on.)  
20:57:32 (Lift-off.)  
20:58:17 (AIS data off.)  
21:16:36 Tilt is about 3 or 4 down. I'm really penetrating visually. The radar says most of it is off to the left.  
21:16:52 METRO: UHF reports the #2 storm is more active electrically.  
21:16:59 Therefore we should stay in this one, correct?

AIS Record 2 - Penetration 1.

21:17:10 (Data on.) Data is on and getting ready to enter.  
21:17:17 Storm entry. (Event.)  
21:17:22 Turbulence, some precip.  
21:17:31 Pretty bright so we are pretty close to top.  
21:17:47 Moderate precip.  
21:17:52 Pretty smooth.  
21:18:01 We're out.  
21:18:02 (Event - storm exit.)  
21:18:09 (Data off.)  
21:19:19 METRO: We recommend a heading of 060° right now.  
21:19:29 We're turning.

AIS Record 3 - Penetration 2.

21:19:30 (Data on.)  
21:20:55 METRO: SPANDAR reports tops 38,000 in that one you are headed for now.  
21:21:01 We're looking over it.  
21:21:06 Good updraft. I didn't do that.  
21:21:11 Real good updraft there.  
21:21:13 And some turbulence now.  
21:21:21 (12 channels LeCroy data for strike.)  
21:21:23 Saw a strike on right wing tip!  
21:21:28 METRO: Roger that.  
21:21:29 And got trigger.  
21:21:39 Another strike! Saw it on right wing tip.  
21:21:48 We're out.  
21:21:59 METRO: Make a 180° and go back. (Data off.)  
21:22:07 We're doing it.

## AIS Record 4 - Penetration 3.

21:24:00 (Data on.)  
21:24:11 Tilt 5 down now. Can barely see something out there.  
21:24:16 (Event - storm entry.)  
21:24:18 Storm entry. Heading 210° altitude 28-7.  
21:24:36 Little percip.  
21:24:43 Good updraft again.  
21:25:13 Gonna have to back off and take a look.  
21:25:19 Very quiet this time.  
21:25:23 METRO: We show you almost out of the cell.  
21:25:32 METRO: At your 2 o'clock position 10 miles, there's  
another level 3 flashing, now 3 o'clock.  
21:25:54 How far down you looking?  
5 down.  
21:25:57 We got some yellow at 17 miles looking 5 down.  
21:26:04 METRO: What heading?  
21:26:05 280°  
21:26:09 METRO: That's the one we're seeing. That's the hottest  
spot we see.  
21:26:13 We are on our way.  
21:26:58 10 miles on range.  
21:27:01 Getting a little more turbulence now.  
21:27:03 You been switching cameras on and off?  
21:27:06 Yeah. I missed first strike.  
21:27:13 See those two spots of yellow out front. I really be-  
lieve there's some yellow in between because of ....  
21:27:23 Yep.  
21:27:28 Looks like might be a pretty good storm.  
Staying with us.  
21:27:41 METRO: What does it look like in this one?  
21:27:43 (Event - second cell entry.)  
21:27:44 We're just entering.  
21:27:51 There's 5 miles about 3 down.  
21:27:54 We still see a little yellow up close.  
21:28:02 METRO: Did you get a nearby?  
21:28:04 Lot of rain, that's what he got.  
21:28:07 Lot of rain and pretty good turbulence.  
21:28:12 We're out.  
21:28:13 (Event - cell exit.)  
21:28:17 METRO: 90° - 270° and back in.  
21:29:01 METRO: We show level 4 in the storm you just penetrated.  
21:29:07 We were showing yellow as we got to it.  
21:29:11 METRO: We're looking at it at about 16,000 ft, of course.

## AIS Record 5 - Penetration 4.

21:30:00 (Data on.)  
21:30:10 Looks as good as any I guess. Pretty bumpy in here.  
21:30:18 Look at that hook off to right.  
21:30:21 (Event - cell entry.)  
21:30:23 Back in. Heading 70° altitude 28-6.  
21:30:33 Pretty good precip and turbulence.

21:30:47 Out of that one.  
21:30:49 (Event - cell exit.)  
21:31:04 METRO: 12 o'clock, 20 miles.  
21:31:14 Can't prove it by me.  
21:31:18 He's talking about that thing over there, to left.  
21:31:24 Give me range and bearing again.  
21:31:29 METRO: 12 o'clock at about 15 miles. It's come around to a heading of about 070°.  
21:31:38 It's that green thing off to left.  
21:33:32 I think all we got out that one was one bump.  
21:33:37 METRO: 90° - 270° back on heading of 260°.  
21:34:20 Weapon bay 80°.  
21:36:47 Holy smoke! I don't know where it came from but the stormscope just filled up.

## AIS Record 6 - Penetration 5.

21:36:56 There's one right there! (12 channels LeCroy data.)  
21:36:57 Was that a strike?  
21:37:00 (Data on.)  
21:37:06 METRO: We have triggers.  
21:37:09 That's affirmative. We just saw a big bolt go down. We were talking about whether it were a strike or not.  
21:37:15 I saw the bolt vertical.  
21:37:17 I did too but I didn't see it attach.  
21:37:21 We saw a vertical bolt to left of us.  
We didn't see it attach to airplane.  
21:37:27 METRO: UHF saw lightning behind you at that time. We're going to tentatively call it a trigger, that doesn't say it was a strike.  
21:37:37 If it was - Brown you'd say it was a strike.  
21:37:46 METRO: Be advised that the next cell ahead of you, the number one storm is alleged to have 33,000 tops and lightning. The one you are in is 28,000.  
21:38:05 We are getting a lot of turbulence here.  
21:38:12 (Event - cell exit.)  
21:38:21 Range to Langley, INS?  
21:38:29 129  
21:39:40 5 down on tilt.  
21:40:06 (Event - second cell entry.)  
21:40:09 We're entering this one now.  
21:40:22 A rough one. The left wing really came up then.  
21:40:35 Lot's of precip.  
21:40:36 Lot of precip.  
21:40:39 Good bumps.  
21:41:03 Got some good turbulence in this.  
21:41:13 METRO: Nearby.  
21:41:15 Didn't see it.  
21:41:17 (Event - cell exit.)  
21:41:18 We're out in the clear.  
21:41:30 METRO: The #2 cell looks like it maybe hotter than the

one you just went thru but not a nickels worth of difference between them.  
21:41:37 (Data off.)  
21:41:42 Fuel state 5.8  
21:42:32 At what altitude does UHF say the lightning is happening?  
21:43:09 METRO: They are showing 26K. Do you want to drop down a little bit?

## AIS Record 7 - Penetration 6.

21:43:10 (Data on.)  
21:43:15 OK next pass.  
21:43:16 (Event - storm entry.)  
21:43:19 Back in it now.  
21:43:21 Percip.  
21:43:41 Pretty bumpy thru here.  
21:43:50 METRO: Nearby?  
21:43:53 Didn't see anything.  
21:44:18 (Event - cell exit.)  
21:44:20 Broke out of that cell.  
21:44:25 METRO: Off about 1 o'clock and 12 miles.  
21:45:37 Metro, what do you show as BINGO from this range?  
21:46:07 (Event - second cell entry.)  
21:46:13 We're in next cell.  
21:46:13.5 (12 channels LeCroy data and aft camera recorded strike.)  
21:46:14 Strike!  
21:46:25 METRO Data on? (Event - cell exit.)  
21:46:27 Affirmative and camera.  
21:46:41 (Data off.)  
21:48:31 Going up to about 27. Storm at 12 o'clock 3 and 4.  
May be 3 miles across. Irregular shape.  
21:48:53 Going 10 miles range, 3 down on tilt. Have 2 cells.  
One at 7 miles off to left and 1 at 8 miles off to right.  
Try to get them both. I bet it is darn near impossible.  
21:49:08 Updraft there.

## AIS Record 8 - Penetration 7.

21:49:10 (Data on.)  
21:49:28 METRO: Flash? (Event - storm entry.)  
21:49:30 No. Not here.  
21:49:35 Didn't see it here but we're back in.  
21:49:40 Camera?  
21:49:42 On.  
21:49:55 20 miles, 3 down on tilt.  
21:50:07 (Event - breakout.)  
21:51:36 (Event - back in.)  
21:51:48 We're back in the cloud part of it.  
21:51:55 I heard a pop.  
21:51:59 Didn't see anything.  
21:52:02 Getting some slight turbulence.

21:52:05 What's stormscope say?  
21:52:07 Just has a few horizontal dots on it.  
21:52:18 Some precip.  
21:52:31 Little heavier precip.  
21:52:39 Good bump or 2.  
21:52:47 METRO: Nearby a strike?  
21:52:49 Didn't see either.  
21:52:53 A good bump.  
21:52:58 (Aft camera recorded strike.)  
21:52:59 Strike!  
21:53:00 Heavy precip.  
21:53:03 No trigger.  
21:53:03:04 (12 channels of LeCroy data recorded a strike.)  
21:53:11 METRO: I think you got 2 strikes.  
21:53:13 I just got a trigger. I don't know where it came from.  
21:53:18 METRO: I saw 2 strikes.  
21:53:29 (Event - storm exit.)  
21:53:39 (Data off.)  
21:54:43 METRO: We show a level 4 right in front of you.

## AIS Record 9 - Penetration 8.

21:55:18 (Event - storm entry.)  
21:55:20 (Data on.)  
21:55:25 We're back in.  
21:55:31 Precip pretty heavy.  
21:55:34:9 (12 channels LeCroy and Aft camera recorded strike.)  
21:55:36 Strike! Triggers.  
21:55:41 Another strike!  
21:56:1 METRO: Lightning is behind you now.  
21:56:46 (Event - storm exit.)  
21:56:49 (Data off.)  
21:56:54 Metro, what do you show for BINGO from here?  
21:57:08 METRO: We are showing 4,600 on board, is that confirmed?  
21:57:09 Check.  
21:57:16 Hey a strike down there! I don't think we got hit. It was way down below us.  
21:57:32 METRO: We show BINGO another 4 to 5 minutes.  
21:57:57 METRO: We count 8 strikes.  
21:58:23 This thing just started building, you know it?

## AIS Record 10 - Penetration 9.

21:58:40 (Data on.)  
21:58:51 (Event - storm entry.)  
21:58:53 We're back in.  
21:58:58 Got a pretty good spot of yellow in front of us now.  
21:59:55 Distant flashes.  
22:00:03 Bright flashes.  
22:00:05.6 (12 channels LeCroy recorded strike.)

22:00:07 METRO: Strike?  
12:00:10 Got triggers. Didn't see one.  
22:00:11 Oooh.  
22:00:12 Ah. A hard bump.  
22:00:20 Another hard bump.  
22:00:25 (Event - storm exit.)  
22:00:29 I'm gonna make one more penetration on the way back then  
I'm coming home.  
22:00:35 (Data off.)  
22:00:31 METRO: We agree.  
22:02:07 Some red there now.

## AIS Record 11 - Penetration 10.

22:02:20 (Data on.)  
22:02:39 (Event - storm entry.)  
22:02:41 We're back in.  
22:02:47 Heavy precip.  
22:02:50 Turbulence.  
22:02:54 (Aft camera recorded strike.)  
22:02:55 Strike! (Audible on tape.)  
22:02:56 METRO: Strike.  
22:03:00 No triggers that time.  
22:03:23 We're out. (Event - storm exit.)  
22:03:33 METRO: Turn to about 90° and about 20 miles there's  
that other storm on the way home.  
22:03:39 Sorry about that. I'm coming home.  
22:05:10 Good updraft. I lost my checklist.  
22:05:35 Should break out shortly.  
22:05:45 What's range to home?  
22:05:47 126.  
22:06:16 This is a cal on DLite.  
22:07:39 (Data off.)

## AIS Record 12 - Landing.

22:24:50 (AIS data on.)  
22:25:42 (Touch-down.)  
22:26:21 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-019 F-106B

Date June 5, 1984

Crew Neely/Winebarger

Engine Start 20:45:10

Take-off 20:57:32

Landing 22:25:42

Lightning Systems:

Dlite 6 Triggers  
10ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{B}_{W,L}$  3  $\dot{B}_{W,R}$   
10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$   
10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$   
10ns LeCroy IV.1 TP101 2  $\dot{D}_N^I$  3  $\dot{I}_T$   
Digital Peak Counter 1  $\dot{I}$  INOP 2  $\dot{D}_F$  INOP

Aft movie camera 4 Strikes

Cockpit cameras NI

Stereo Fwd \_\_\_\_\_

Hass aft \_\_\_\_\_

Aft video \_\_\_\_\_

Field Mills (4) OK

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Lightning damage

Passive protection \_\_\_\_\_

Diverter strips OK

Wire mesh \_\_\_\_\_

Stormscope Aft OK 0.5 OK

Non-Lightning Systems:

AIS PINOP. Lost  $\beta$  vane.

INS OK

Telemetry:Top NU

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Region Luray, VA

Pens 10

Strikes 10

Nearbys 0



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84-019

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape NUDigital dBZ Tape PINOPLDAR NUUHF Radar Real Time only.C-Band Tracking OKGoddard Antennas NU-Too far.GSFC NUWFF NULaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots IntermittentWFF Tape OK

Debrief Notes for Flight 84-020, June 6, 1984

Storm Flight/Dulles and Baltimore-  
Washington Int'l Airports

Brown/Fisher

GMT

19:00:08 (Engine start.)  
19:01:00 (DLite master power on.)

AIS Record 1 - Takeoff.

19:14:00 (AIS data on.)  
19:14:39 (Takeoff.)  
19:15:17 (AIS data off.)  
19:29:57 (DLite instrumentation on.)  
19:31:22 (Voice recorder on.)  
19:31:35 (Video recorder on.)  
Metro, we are turning back to 020°. We have one cell  
at 55. More or less in line, we are going to try to  
get.  
19:31:45 METRO: Take them all if you can. If you get stuck in  
the first one, we may turn you back to it.

AIS Record 2 - Pens #1 - 6.

19:32:50 (AIS & DLite data on. Begin Pen #1.)  
19:33:12 Data systems are on.  
19:33:28 Event for cloud entry. (Event.)  
19:33:35 Data on for Pen #1, FL 310, heading 020°.  
19:33:45 Bright, calm and dry.  
19:33:58 Occasional very light turbulence.  
19:34:06 -6° tilt.  
19:34:22 Camera on. (External camera on.)  
19:34:34 Some real light precip.  
19:34:38 Very light turbulence.  
19:34:55 Turbulence now continuous light, and so is the rain.  
19:35:12 Conditions unchanged.  
19:35:15 Just about into heavy part.  
19:35:22 Light rain, light turbulence with occasional moderate.  
19:35:26 SPANDAR: 816. I see a small dot - level 5 - dead  
ahead of you, but it is below you.  
19:35:33 Cloud exit - event. (Event.)  
19:35:36 Camera off. (External camera off.)  
19:35:54 Turn data off momentarily. (End of Pen #1.)  
19:36:12 Data back on. (Begin Pen #2.)  
19:36:22 SPANDAR: We showed you going thru the hottest spot  
in that area. There was some level 5 in it, below your  
altitude. It is the hottest spot around.

19:36:27 (Clear stormscope.)  
19:36:32 We've got some cells at 15 and 20 miles and that's the only things we see.  
19:36:41 METRO: That's going to put you pretty far away. I'd like you to 90° - 270° back.  
19:36:45 (Event for cloud entry.)  
19:36:49 Cloud entry with an event.  
19:36:53 816 is in Pen # 2, FL 310, 035,° continuous light turbulence and light rain.  
19:37:02 Camera on. (External camera on.)  
19:37:30 Fairly calm and dry up here now.  
19:37:41 A little return at 2 miles, then another one at 5.  
19:37:46 Continuous light turbulence, light rain.  
19:38:01 Some flashes.  
19:38:01 Nearby flashes on left side, no triggers.  
19:38:04 Light turbulence, light precip.  
19:38:14 Some rain.  
19:38:16 Rain a little bit heavier. Still call it light.  
19:38:18 Light turbulence.  
19:38:29 Camera off. (External camera off.)  
19:38:34 Event for cloud exit. (Event.)  
19:38:55 (Event for reentry.)  
19:38:57 Event for reentry.  
19:39:01 Data still on.  
19:39:05 Breakout. We are right on top of this cell.  
19:39:16 Breakout, right.  
19:39:24 Complete cloud exit, event. (Event.)  
19:39:33 Data systems are off. (End of Pen #2.)  
19:39:44 METRO: We see the one you are going for. It does not look like a very hot cell, and if Center can reverse your course, it will be much better. We have lost your TM signal.  
19:40:03 Turning left and reversing course.  
19:40:10 TM switches are on.  
19:40:23 One burst of flashes and that was it.  
19:41:19 (Clear stormscope.)  
19:42:28 155 (n.mi.) out.  
19:42:30 Data systems are on. Pen #3, FL319, heading 185°. (Begin Pen #3.)  
19:42:41 Cloud entry with event. (Event.)  
19:43:00 Partial breakout on right. We are between cells.  
19:43:13 Event - reentry. (Event.)  
19:43:19 Camera on. (External camera on.)  
19:43:24 Light rain, occasional light turbulence.  
19:43:25.2 (DLite LeCroy crates 1-4 trigger & external camera records a strike.)  
19:43:26 Good strike.  
19:53:28 4 Triggers. To the noseboom.  
19:43:30 A good one.  
19:43:33 Seemed to be pretty symmetric. Left and right, in other words. It was right on the nose.  
19:43:40 Light to moderate turbulence now and light rain.

19:43:42 Nearby flash.  
19:43:46 All triggers are back.  
19:43:52 Nearby flash overhead.  
19:43:53.4 (DLite LeCroy crates 1-4 trigger & external camera records a strike.)  
19:43:54 Good strick! Right side.  
19:43:57 4 triggers.  
19:43:59 Light rain and light turbulence at the time.  
19:44:05 Keep data on, but I'm going to start our 90°-270°.  
19:44:42 Camera off. (External camera off.)  
19:45:03 Data staying on in turn at same altitude in clouds.  
19:45:56 Smooth, dry and bright in the turn.  
19:46:12 Almost ready to break out thru here.  
19:46:30 METRO: UHF advise 10 hits a minute in the cell at 10 nautical, about 025°.  
19:46:41 That's where we are going.  
19:46:53 Data systems have been cycled for Pen #4, FL310. Initial heading 360°. (End Pen #3, begin Pen #4.)  
19:47:00 Event. Cloud entry. (Event.)  
19:47:45 Be heading about 345° then.  
19:47:50 Camera on. (External camera on.)  
19:48:01 Light rain, continuous light turbulence.  
19:48:27 Light to moderate turbulence, continuous light rain.  
19:48:35 (Clear stormscope.)  
19:48:42 METRO: UHF indicates optimum altitude 28,000 ft.  
19:48:49 Camera off. (External camera off.)  
19:49:03 (Event for cloud exit.)  
19:49:33 Data systems off. (End of Pen #4.)  
19:49:51 (Clear stormscope.)  
19:52:25 Camera on. (External camera on.)  
19:52:28 Event for cloud entry.  
19:52:34 Data on for Pen #5, FL310, heading east. (Begin Pen #5.)  
19:52:38 Cloud entry.  
19:52:43 Continuous light rain and light turbulence.  
19:52:45.3 (DLite LeCroy crates 1-4 trigger & external camera records a strike.)  
19:52:46 Good strike, right side.  
19:52:48 4 triggers.  
19:52:53 Light rain and light turbulence at that time.  
19:53:01 Conditions unchanged but getting much darker in this part of the storm.  
19:53:05 Probably in the shadow of the anvil.  
19:53:08 Cloud exit. (Event for cloud exit.)  
19:53:46 (Clear stormscope.)  
19:54:34 Bring data systems on here. (End Pen #5. Begin Pen #6.)  
19:54:53 Camera on. (External camera on.)  
19:54:55 Cloud entry, event. (Event.)  
19:55:02 Penetration #6, FL 310, heading 210°, roughly.  
19:55:09 Light rain and continuous light turbulence.  
19:55:12 Very light turbulence.  
19:55:19.5 (DLite LeCroy crates 1-4 trigger on nearby flash.)

19:55:33 METRO: Did you get strike back there? We showed triggers.  
19:55:35 That's an affirmative.  
19:55:39 Let's keep everything on. We got some more.  
19:55:40 Whoops - we did get triggers and I didn't even see them.  
19:55:42 We are not sure about that one.  
19:55:45 I see the triggers up here now that you mention it, but  
I didn't see the strike.  
19:55:53 Nearby flashes.  
19:55:55 Light turbulence, light rain.  
19:56:14 Conditions unchanged.  
19:56:27 Descending thru 29. (FL 290.)  
19:56:44 Camera off. (External camera off.)  
19:56:47 (Clear stormscope.)  
19:57:10 About 5.9 for fuel  
19:57:15 138 from home.  
19:57:35 Cloud exit, low left.  
19:57:50 Leveling off at (FL) 280.  
19:58:13 (Clear stormscope.)  
19:58:26 Cycle data systems.  
19:58:31 (AIS & DLite data off.)

## AIS Record 3 - Pen #7.

19:58:50 (AIS & DLite data on.)  
19:58:55 Data systems are back on.  
19:58:57 Camera on. (External camera on.)  
19:59:04 Data systems cycled for Pen #7, FL 280, heading 020°.  
19:59:10 Light rain, light turbulence.  
19:59:17 Nearby flash.  
19:59:21 Another nearby flash.  
19:59:37 Rain a little bit heavier.  
19:59:38 Turbulence is ....  
19:59:38.2 (DLite LeCroy crates 1-4 trigger & external camera records  
a strike.)  
19:59:39 Direct strike.  
19:59:41 Light turbulence, light to moderate rain.  
19:59:44 4 triggers.  
19:59:49 Another 5 miles of this to go.  
20:00:08 Continuous light rain and light turbulence.  
20:00:18 Nearby flashes.  
20:00:26 Moderate rain now.  
20:00:30 Just about thru this.  
20:00:32 And rain falls off to nil.  
20:00:37 Camera off. (External camera off.)  
20:00:38 (Cloud exit AIS & DLite data off.)  
20:00:40 Data off, at cloud exit.  
20:00:57 METRO: Weapons bay temp?  
20:01:07 78°.

## AIS Record 4 - Pen #8.

20:02:56 Data systems on.  
20:03:00 (AIS & DLite data on. Time code stable.)  
20:03:01 SPANDAR: We just lost radar beacon. Did you lose power  
to the beacon or something?  
20:03:09 Not that we know of.  
20:03:21 Data systems are on for Pen #8, FL 280, heading due  
south.  
20:03:28 (Event for cloud entry.)  
20:03:30 Event.  
20:03:32 Camera on. (External camera on.)  
20:03:38 Light rain, occasional light turbulence.  
20:03:46 0° on tilt. A dot of yellow ahead.  
20:03:53 Continuous light rain and light turbulence.  
20:04:00 Nearby flash.  
20:04:06.3 (DLite LeCroy, crates 1-4 trigger & external camera records  
a strike.)  
20:04:08 I don't know if that was a hit or not, close.  
20:04:10 We got triggers.  
20:04:11 Extremely close nearby flashes. I heard thunder, I think.  
20:04:16 I think it must have hit underneath.  
20:04:19 It was continuous light rain, and light turbulence.  
20:04:27 Nearby flash.  
20:04:33 Light to moderate turbulence, continuous light rain, go-  
ing to moderate rain.  
20:04:41 Good bounce, moderate turbulence.  
20:04:44 Nearby flashes, ahead.  
20:04:55 Nearby flash.  
20:05:02 Rain has almost died off. Still occasional turbulence.  
20:05:08 Camera off. (External camera off.)  
20:05:11 Do 90° - 270°.  
20:05:23 136 to Langley.  
20:06:03 Data systems still on except camera.  
20:06:27 (Clear stormscope.)  
20:07:08 Calm. Dry. Bright, but still in clouds.  
20:07:20 Light turbulence now.  
20:07:50 (AIS & Dlite data off.)  
20:08:03 Cycle data system in the clouds for Pen #9, FL 280, head-  
ing 010°.

## AIS Record 5 - Pen #9.

20:08:10 (AIS & DLite data on.)  
20:08:34 (Clear stormscope.)  
20:08:51 Camera on. (External camera on.)  
20:08:57 Light turbulence, but no precip.  
20:09:19 Light rain and light turbulence.  
20:09:29.3 (DLite LeCroy crates 1-4 trigger & external camera records  
a strike.)  
20:09:30 Good strike! Nice bright one right side.  
20:09:34 4 triggers.  
20:09:35 Lots of noise.  
20:09:59 Continuous light rain and light turbulence.

20:10:19 Camera off. (External camera off.)  
20:10:23 Cloud exit, event. (Event.)  
20:10:27 Data systems off. (AIS & DLite data off.)  
20:10:35 5.2 fuel.  
20:11:05 SPANDAR, Do you have my transponder back again?  
20:11:08 SPANDAR: Negative. We're looking to make sure it isn't  
a ground problem.  
20:11:16 Does METRO have INS track?  
20:11:19 Roger.  
20:11:26 METRO: Wouldn't be out there if we didn't.  
20:11:41 These strikes have been very bright. Very intense  
channels.

## AIS Record 6 - Pen #10.

20:12:57 Data systems on. Pen #10, FL280. Initial heading 160°.  
20:13:00 (AIS & DLite data on. Time code stable.)  
20:13:22 (Clear stormscope.)  
20:13:26 Event for cloud entry. (Event.)  
20:13:42 Smooth and dry so far.  
20:13:46 With that cell occasional light turbulence and continuous  
light rain.  
20:14:07 Continuous light turbulence and light rain.  
20:14:32 Camera on. (External camera on.)  
20:14:39 Breakout left.  
20:15:07 Cloud exit. (Event.)  
20:15:14 Camera off. (External camera off.)  
20:15:15 (AIS & DLite data off.)  
20:15:16 Data off.  
20:15:25 METRO: I show you about 5 minutes from RTB.  
20:15:30 We generally concur.  
20:15:35 Cloud exit and all data systems are off.  
20:17:12 Data systems coming on.

## AIS Record 7 - Pen #11.

20:17:25 Data systems on for Pen #11, FL 270, heading 300°.  
20:17:30 (AIS & DLite data on. Time code stable.)  
20:17:40 Camera on. (External camera on.)  
20:17:42 Event for cloud entry. (Event.)  
(Voice recorder out of tape.)  
20:17:50 In moderate turbulence now. Lot of rising and falling  
going on here and light rain.  
20:18:18.6 (DLite LeCroy crates 1-4 trigger & external camera records  
a strike.)  
20:18:20 Nearby flashes. No sound, but 4 triggers.  
20:18:26 They were pretty close. Up front camera was on.  
20:18:31 Light to moderate turbulence and light rain at the time.  
20:19:04 Continuous light rain and light turbulence.  
20:19:12 Camera off. (External camera off.)  
20:19:31 Partial cloud exit.  
20:19:43 Cloud exit, event. (Event.)

20:19:48 Data systems off.  
20:19:49 (AIS & DLite data off.)  
20:20:14 METRO: We show you at RTB point.  
20:20:17 I'm little better than that, I got 4.6.  
20:20:22 METRO: 150 out.

## AIS Record 8 - Pen #12.

20:21:00 Data systems are on.  
20:21:18 Event - cloud entry. (Event.)  
20:21:20 (AIS & DLite data on. Time code stable.)  
20:21:31 Data systems on for Pen #12, FL 270, Heading 110°.  
20:21:38 (Clear stormscope.)  
20:21:55 Occasional light turbulence, no precip.  
20:22:11 (Clear stormscope.)  
20:22:24 Very light rain and occasional light turbulence.  
20:22:42 Camera on. (External camera on.)  
20:22:45 Nearby flashes on left.  
20:23:02 Continuous light rain, occasional light turbulence.  
20:23:20 Moderate rain. Continuous light turbulence.  
20:23:33 Nearby flashes overhead.  
20:23:35 Rain to light.  
20:23:43 Camera off. (External camera off.)  
20:23:47 Partial breakout on left.  
20:23:53 (Event for cloud exit.)  
20:24:01 Event for cloud exit back there.  
20:24:05 (AID & DLite data off.)

## AIS Record 9 - Pen #13.

20:27:14 Data systems on.  
20:27:30 (AIS & DLite data on. Time code stable.)  
20:27:35 Data systems on for Pen #13, FL265, heading 200°. A  
new cell.  
20:27:45 Camera on. (External camera on.)  
20:27:50 (Event for cloud entry.)  
20:27:58 Light to moderate rain, and light to moderate turbulence.  
20:28:00 Cloud exit. (Event.)  
20:28:01 Camera off. (External camera off.)  
20:28:10 (AIS & DLite data off.)  
20:29:23 (Voice recorder off.)  
20:29:30 (Video recorder off.)

## AIS Record 10 - DLite cals.

20:30:20 (AIS & DLite data on.)  
20:30:41 (Turn stormscope off.)  
(2 sets of cals.)  
20:31:37 (AIS & DLite data off.)  
20:31:58 (DLite instrumentation off.)  
20:32:15 (DLite master power off.)



Flight 84-020

8

AIS Record 11 - Landing with external camera.

20:47:20 (AIS data & external camera on.)  
(External camera out of film.)  
20:50:04 (Landing.)  
20:50:47 (AIS data off.)

AIS Record 12 - chocks.

20:53:20 (AIS data on.)  
20:54:15 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-020 F-106B

Date June 6, 1984

Crew Brown/Fisher

Engine Start 19 : 00 : 08

Take-off 19 : 14 : 39

Landing 20 : 50 : 04

## Lightning Systems:

Dlite 7 Triggers

10ns LeCroy I.1  $\dot{D}_F$  2  $\dot{B}_{W,L}$  3  $\dot{B}_{W,R}$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F$  NG

## Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon PINOP Failed  
in flight

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 7 Strikes.

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4)  $\dot{E}_X$  Intermittent

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP Strike damage.

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Dulles to BWI,

Baltimore

Pens 13

Strikes 7

Nearbys 1

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 020

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar Real time onlyC-Band Tracking INOP

Goddard Antennas

GSFC NUWFF NULaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots PINOP IntermittentWFF Tape OK

Debrief Notes for Flight 84-021, June 7, 1984

Storm/New Point Comfort and Oceana, VA

Brown/Rondeau

GMT

19:38:00 (Engine start.)

AIS Record 1 - Takeoff.

19:51:10 (AIS data on.)

19:53:23 (Lift off.)

19:54:19 (AIS data off.)

AIS Record 2 - 5 Short bursts.

AIS Record 5 - DLite calcs.

20:16:20 (AIS data on.)

20:17:07 (DLite calcs with no DLite tape.)

20:19:45 (DLite data on.)

20:19:51 (DLite calcs.)

20:20:32 (DLite calcs.)

20:21:40 (Clear Stormscope.)

20:21:49 (AIS & DLite data off.)

AIS Record 7 - Storm Pen #1.

20:31:00 (AIS & DLite data on. Cloud entry.)

20:31:12 Okay, lets go ahead. The data systems on.

We're 9 miles from the storm.

20:31:28 Penetrating at 300°, FL 200.

20:32:01 Cameras on, penetration. (External camera on.)

Good we've got some yellow in there. We're looking down 5°. Do I need to tell them a time or anything?

No, you can tell them what heading.

20:32:15 305°

20:32:25 Slight turbulence.

20:32:30 Moderate rain.

20:32:51 Leaving the storm. (Cloud exit.)

20:32:52 OK, Cameras off. Data systems off.

20:32:53 Hold off on the camera until we're actually in. (All data on.)

AIS Record 8 - Pen #2.

20:36:30 (All data on.)

20:36:38 Cloud entry. Camera on. Slight turbulence, slight precip.

20:36:49 Make sure you're using UHF, not VHF, because we've switched radios.

Oh! OK, I'm using the wrong one, then.

The UHF is on the handle?

20:37:00 (Cloud exit.)  
20:37:08 No, the throttle's on the left side.  
20:37:17 (External camera off.)  
20:37:28 (AIS & DLite data off.)

## AIS Record 9 - Pen #3.

20:40:20 (AIS & DLite data on. Cloud entry .)  
20:41:33 Moderate rain.  
20:41:47 (All data off. Cloud exit .)

## AIS Record 10 - Pen #4.

20:41:01 (All data on. Cloud entry .)  
20:44:18 I think we're going to get a strike.  
20:44:27 Is this heavy turbulence?  
Yes, this is heavy.  
20:44:35 Nearby flashes.  
20:45:11 We're in good shape, we can stay out here.  
Let's cut the camera off.  
20:45:14 (All data off. Cloud exit .)

## AIS Record 11 - Pen #5.

20:47:38 OK, hold the camera.  
20:47:38 (Cloud entry.)  
20:47:45 What's the heading?  
Our heading is going to be 315°.  
20:47:50 (AIS and DLite data on. Time code stable.)  
Negative 3° on the tilt.  
20:48:54 Cameras on. (External camera on.)  
20:48:54 (LeCroys 1-4 trigger.)  
20:49:03 Look at your lights.  
Which lights?  
Should be some lights which indicate whether we got a  
strike. Four of 'em.  
Yeah they're on, They've been on.  
20:49:24 (Cloud exit.)  
20:49:26 (All data off.)

## AIS Record 12 - Pen #6.

20:52:14 Look at that cloud just to the left.  
20:52:19 Camera on. (External camera on.)  
20:52:20 (AIS & DLite data on. Time code stable. Cloud entry .)  
20:52:21 I do need to call that into them don't I?  
Yes.  
20:52:38 We're getting moderate to heavy.  
20:53:08 OK, turn the camera off. (External camera off. (Cloud  
exit.)  
20:53:11 (AIS & DLite data off.)

## AIS Record 13 - Pen #7.

20:53:30 (Estimated time for LeCroy 1-4 triggers & strike.)  
20:53:36 Unfortunately the camera was off.  
Did you have it back on?  
No.  
You didn't read them, I guess, did you?  
METRO: To turn data back on.  
No. I didn't. Shoot!  
20:53:40 AIS & DLite data on. Time code stable. Cloud entry. )  
20:53:55 OK, let's do this. Keep it off now, because we're out  
of the cloud.  
The data system and the camera?  
Yeah.  
20:54:01 (All data off. Cloud exit. )

## AIS Record 14 - Pen #8.

20:55:37 Let's go ahead and cut the camera on.  
20:55:49 Maybe we'll get one in the cloud.  
20:55:50 (All data on. Time code stable. Cloud entry .)  
20:56:01 There's a storm at seven miles.  
20:56:31 OK. Let's cut the camera on.  
I already turned it on.  
20:56:53 We're just about in it.  
20:57:30 (All data off. Cloud exit. )

## AIS Record 15 - Pen #9.

20:58:50 (AIS & DLite data on. Cloud entry. )  
21:00:01 OK, let's cut the data system on.  
21:00:09 And camera on. (External camera on.)  
21:00:44 Nearby flashes.  
20:00:56 Let's go camera off and leave the system on. (External  
camera off.)  
21:01:04 Do we have camera off?  
Yeah.  
After you throw the switch, let me know.  
21:01:14 What's the count on the camera say now?  
It says 19, but I think it's still going.  
Yeah, I think something is screy.  
21:02:59 (AIS & DLite data off. Cloud exit .)

## AIS Record 16 - Pen #10

21:03:50 (AIS & DLite data on. Cloud entry . External camera on.)  
21:04:31 Negative 5° tilt now.  
That little return that's in 10 miles, just to the  
right of the nose, is about to disappear.  
21:05:06 Seven miles now.  
21:05:14 There it is. That little thing just a head of us.  
21:05:21 Just leave the data system on we'll fly through this  
little thing. OK.

21:05:44 This one's not much better.  
21:06:10 (All data off. Cloud exit .)

## AIS Record 17 - Pen #11

21:08:30 (All data on. Cloud entry .)  
21:09:26 (All data off. Cloud exit .)

## AIS Record 18 - Pen #12

21:13:08 (External camera on.)  
21:13:19 Heavy turbulence and moderate ....  
21:13:20 (AIS & DLite data on. Cloud entry .)  
21:13:22 Good strike, right side. (LeCroys 1-4 trigger.)  
Strike to the nose. Got triggers.  
Good.  
21:13:30 Heavy turbulence. Nearby flashes.  
21:13:51 Turn the camera off, keep the data systems on. (External  
camera off.)  
21:14:12 Data system off.  
21:14:13 (AIS & DLite data off. Cloud exit .)

## AIS Record 19 - Pen 13.

21:15:30 (AIS & DLite data on. Cloud entry .)  
21:15:38 OK, let's cut the camera on.  
Camera on. (External camera on.)  
21:15:52 Tilt's -3°.  
21:16:06 METRO: 315°, 7 miles, level 5.  
21:16:16 I don't see any level 5. I've been changing the tilt angle.  
OK, we're just about on the storm now, couple of seconds.  
21:16:26 Nearby flashes. Don't transmit that, we'll just talk  
about it on the intercom.  
21:16:30 Heavy turbulence.  
21:16:39 Moderate rain.  
21:16:47 OK, We're getting some hail there. A little bit of hail.  
21:15:56 Data systems off. Data off.  
21:16:59 (All data off. Cloud exit .)

## AIS Record 20 - Pen #14.

21:18:27 Data systems on.  
21:18:29 METRO: Level six due east of you.  
21:18:32 Level six! I sure can't see it.  
I can't either. I see a little bit. We'll stay to the right.  
21:18:40 (AIS & DLite data on. Cloud entry .)  
21:18:41 Camera on. OK. (External camera on.)  
21:18:55 Nearby flashes.  
21:18:59 Heavy turbulence, Precip.  
21:19:26 OK, keep the data system on and turn the camera off.  
21:19:30 Camera off. (External camera off.)  
21:19:32 One more pass, and we're on the way home.  
21:19:36 We're going to call some clearance when we start this

turn up there.

21:19:46 We got a lot of little dots on the stormscope.  
21:20:55 OK. This will be our last pass.  
21:21:41 Data systems on. Camera on. (External camera on.)  
(LeCroys 1-4 trigger.)  
21:22:00 Level 5, dead ahead.  
21:22:04 I can't see it.  
21:22:06 Nearby flashes.  
21:22:11 Moderate turbulence.  
21:22:15 Precip, heavy turbulence.  
21:22:27 OK, camera off, data off.  
21:22:30 (All data off. "Cloud exit.")

AIS Record 22 - Landing.

21:31:03 (External camera on.)  
21:30:40 (AIS data on.)  
21:31:13 (Landing.)  
31:31:52 Do you leave the camera on all the way in?  
Yeah, until you get the light to indicate it's out of  
film. Then you can see what it looks like.  
21:33:52 OK, camera light's on now. (External camera out of film.)

AIS Record 23 - Post flight.

21:35:00 (AIS data on.)  
21:37:14 (AIS data off.)



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-021 F-106B

Date June 7, 1984

Crew Brown/Rondeau

Engine Start 19:38:00

Take-off 19:53:23

Landing 21:31:13

Lightning Systems:

Dlite 3 Triggers

10ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{B}_{W,L}$  3  $\dot{B}_{W,R}$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1 NU 2 NU

Aft movie camera 1 Strike

Cockpit cameras NI

Stereo Fwd \_\_\_\_\_

Hass aft \_\_\_\_\_

Aft video \_\_\_\_\_

Field Mills (4) Ex Low gain.

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Strike damage.

Passive protection \_\_\_\_\_

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Non-Lightning Systems:

AIS Lost  $\alpha$  and  $\beta$  vanes \*

INS OK

Telemetry: Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon New Beacon,  
OK

Airborne Radar Video NU

Voice NU

Kavouris Radar

Receiver NU

Region New Point Comfort  
& Oceana

Pens 14

Strikes 3

Nearbys 1

\* Blew circuit breaker prior to takeoff. Both  $\alpha$  and  $\beta$  lost.

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 021

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar Real time only.C-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots PIINOPWFF Tape OK

STORM HAZARDS '84 AIRCRAFT SQUAWK SHEET

Flight No. 84-021

Date: June 7, 1984

1. Standby altitude gyro dead.
2. Fogged HSI.

Flight 84-022, June 11, 1984

Familiarization Flight/ Local

Neely/Rondeau

No notes taken.

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 022 F-106B

Date June 11, 1984

Crew Neely/Rondeau

Engine Start 15:10:00

Take-off 15:29:20

Landing 17:30:00

Lightning Systems:

Dlite 0 Triggers

10ns LeCroy I.1  $\sqrt{D_F}$  2  $B_{W,L}$  3  $B_{W,R}$

10ns LeCroy II.1  $D_T$  2  $I$  3  $B_L$

10ns LeCroy III.1  $D_{W,R}$  2  $D_{W,L}$  3  $D_F$

10ns LeCroy IV.1 TP1012  $I_N$  3  $I_T$

Digital Peak Counter 1 NI 2 NI

Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

Aft movie camera 0 Strikes.

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) OK

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Patuxent River, MD

Pens 0

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84-022

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers NUVideotape NUSatellite Pictures NUWallopsSPANDAR NUVideotape                     Digital dBZ Tape                     LDAR NUUHF Radar NUC-Band Tracking OKGoddard Antennas OKGSFC NUWFF NULaRC NTELF Antenna NTLLP NUWFF Plots                     LaRC Plots                     WFF Tape

Debrief Notes for Flight 84-023 June 11, 1984

Storm Flight/Hagerstown, MD.

Brown/Winebarger

GMT

AIS Record 1 - Takeoff.

19:43:10 (AIS data on.)  
19:43:53 (Liftoff.)  
19:44:43 (AIS data off.)

AIS Record 2 Penetration 1.

20:09:00 (Data on.)  
20:09:04 Data is on for first penetration. Heading 65°. Climbing to 32.  
20:09:28 (Event - Cell entry.)  
20:09:28 Camera on.  
20:09:31 In cloud.  
20:09:37 Some precipitation.  
20:09:42 Little turbulence.  
20:09:52 Pretty good bump.  
20:09:57 Still precipitating.  
20:09:59 Distant flash.  
20:10:05 Gradual right turn to try pick up heavier stuff ahead.  
20:10:20 Momentary breakout.  
20:10:23 (Event - cell exit.)  
20:10:37 (Event - cell entry.)  
20:10:38 Back in next cell.  
20:10:47 Precipitation.  
20:11:14 Pretty smooth. Not much going on. A little precipitation.  
20:11:50 (Event - cell exit) We have one more cell 070° at 10 miles before we reverse.  
20:11:58 Looking down 3°.  
20:12:00 In clear - Broke out.  
20:12:02 Camera off.  
20:12:21 Any stormscope activity?  
20:12:24 Negative.  
20:12:42 Camera on.  
20:12:45 (Event - cell entry)  
20:12:46 Back in clouds for next cell.  
20:12:50 A little yellow on radar for it.  
20:12:56 Negative 3° tilt.  
20:12:58 Getting pretty good precipitation now.  
20:13:06 A little light turbulence.  
20:13:41 Camera off.  
20:14:14 We're in turn - still in cloud. Still have data on.  
20:14:32 (Event - cell exit)  
20:14:34 (Data off.)  
20:14:36 Broke out in clear. Data off.

## AIS record 3 - Penetration 2.

20:15:46 Data back on for penetration 2.  
20:15:50 (Data on.)  
20:15:57 We are in cloud but about 2 1/2 miles from contour.  
20:16:06 32000 ft; heading 165°.  
20:16:11 Inside cell.  
20:16:12 Camera on.  
20:16:23 Some precipitation.  
20:16:35 Camera off.  
20:16:37 (Event - cell exit.)  
20:16:38 Another breakout.  
20:17:13 Negative 3° tilt.  
20:17:20 Negative 5°.  
20:17:19 Doesn't look like anything.  
20:17:34 Negative 3°. Looks like something at 20 miles.  
20:18:05 Negative 2° tilt.  
20:18:12 Negative 3°.  
20:18:16 (Event - cell entry.)  
20:18:18 Back in clouds.  
20:18:57 Clouds, nothing going on.  
20:19:03 Negative 5° on tilt.  
20:19:44 METRO: If you don't get struck in this penetration I'm going to request you drop in altitude a couple thousand.  
20:19:52 Where does UHF say lightning is?  
20:19:55 Camera on.  
20:19:56 METRO: General comment is things are falling.  
20:00:01 Looks that way to us to.  
20:20:07 We're about in first little one.  
20:20:20 Light turbulence.  
20:20:20 Little precipitation.  
20:20:47 Negative 4° on tilt. That little one in front of us is below us.  
20:20:51 (Event - cell exit)  
20:20:55 We broke out again.  
20:21:01 Camera off.  
20:21:15 We have one 15 miles. Bearing 280°.  
20:21:48 METRO: I think you ought to try 2-3000 ft lower.  
20:22:20 (Event - cell entry.)  
20:22:21 Back in next.  
20:22:32 Camera on.  
20:22:42 Drop to 31 now.  
20:22:59 Little precipitation.  
20:23:07 Good bump there.  
20:23:12 Still getting precipitation.  
20:23:22 Pretty good bump there.  
20:23:27 Camera off.  
20:23:30 (Event - cell exit)  
20:23:32 We broke out of that one.  
20:23:38 (Data off)  
20:23:40 Data off for penetration 2.  
20:24:00 METRO: SPANDAR says the tops of that cell you just went through is 41000. We are showing level 4.



## AIS Record 4 - Penetration 3.

20:26:00 (Data on.)  
20:26:16 Data on for penetration for 3. Heading 105°. Altitude 28-8.  
20:26:30 Negative 4° tilt. (Event - cell entry)  
20:26:34 We're back in.  
20:26:39 Precipitation.  
20:26:42 Stormscope?  
20:26:43 Nothing.  
20:28:39 (Event - cell exit.)  
20:28:44 We're out in clear. Turn data off.  
20:28:45 (Data off)  
20:29:09 Negative 4° on tilt.  
20:30:00 We're turning to go into one with no anvil. Just a dome on top.

## AIS Record 5 - Penetration 4.

20:30:05 Data is on. Penetration 4.  
20:30:10 (Data on.)  
20:30:20 Camera on. (Event - cell entry.)  
20:30:22 In the cloud.  
20:30:34 29000 ft. heading 220°.  
20:31:00 (Event - cell exit.)  
20:31:02 (Data off.)  
20:31:04 Data off penetration 4.  
20:31:11 METRO: I show most interesting target about 12 miles 3 o'clock.

## AIS Record 6 - Penetration 5.

20:32:10 (Data on.)  
20:32:12 Data on for penetration. In turn now.  
20:32:25 Penetration 5.  
20:32:32 We're out.  
20:32:33 (Event - cell exit.)  
20:32:35 Momentary breakout.  
20:33:17 Negative 4 tilt.  
20:33:18 (Event-cell entry.)  
20:33:18 Heading 230°  
20:33:59 Little precipitation.  
20:34:17 Camera off and I'm going to make hard right turn.  
20:34:20 (Event - cell exit.)  
20:34:21 Momentary break out again.  
20:34:29 METRO: I show target cell about 10 miles and 28- from your position.  
20:34:34 We concur.  
20:34:43 4 down on tilt. This one is looking pretty good.  
20:35:00 Even level it looks bigger.  
20:35:09 Level- on tilt.  
20:35:22 (Event - cell entry.)  
20:35:25 Back in cloud, heading 280°. Altitude 29000.  
20:35:53 0° tilt.  
20:35:56 Precipitation.  
20:35:59 Pretty heavy precipitation now.

20:36:06 Bright flash.  
20:36:09.3 (All LeCroys triggered and aft camera recorded strike.)  
20:36:10 Think we got one!  
20:36:11 Took a strike! Got triggers.  
20:36:24 We got fair precipitation and moderate turbulence at that time.  
20:36:46 Camera off.  
20:37:02 (Event - cell exit.)  
20:37:06 (Data off)  
20:37:13 Data is off at end of penetration 5.  
20:38:02 METRO: I show another 10 minutes to RTB.  
20:38:55 0° tilt doesn't look as good this time.  
20:39:02 Negative 2°.  
20:39:05 Negative 4°.

## AIS Record 7 - Penetration 6

20:39:10 (Data on)  
20:39:13 Data is on penetration 5. 100° heading. Altitude 29000.  
20:39:20 Negative 4° tilt.  
20:39:22 METRO: penetration 6.  
20:39:24 (Event - cell entry.)  
20:39:26 Affirmative 6.  
20:39:30 We are in the clouds.  
20:39:34 Camera on.  
20:39:49 Good bumps. Little precipitation.  
20:40:00 Pretty good precipitation. Bright flash.  
20:40:10 More flashes.  
20:40:41.5 (All LeCroy's triggered and aft camera recorded strike.)  
20:40:44 I think we got one just as we exited that.  
20:40:48 (Event - cell exit.)  
20:40:47 That hit us?  
20:40:48 I think so.  
20:40:51 Camera off.  
20:48:08 I heard a noise and saw the flash too.  
20:43:24 (Event - cell entry.)  
20:45:06 (Event - cell exit.)  
20:45:08 (Data off)  
20:45:17 Data off. end of penetration #6.  
20:45:42 METRO: The way I see it, you got time to get over there go through that cell, turn around and another penetration back east bound then come on home.  
  
20:46:03 Level on tilt.  
20:46:13 Looks like it built some since we went through it before. That's level. Get wings level.  
20:46:32 Yeah, I think it's little better than it was.  
20:46:58 Negative 2°.  
20:47:03 Negative 3°.  
20:47:29 I guess we may as well head for right hand side of storm since that's where the yellow is showing.  
20:47:37 With the tilt down you are splitting the ---.  
20:47:38 I know it. It seems pretty well split now.  
20:47:53 Data on for penetration 7. Heading 250°. Altitude 29000.

## AIS Record 8 Penetration 7.

20:48:00 (Data on)  
20:48:08 We're in the clouds but we're got 5 miles to go to contour.  
20:48:21 The way the storm is shaped it's hard to tell what the best to do is.  
20:48:30 Camera on.  
20:48:36 Negative 3° tilt.  
20:48:50 Getting some precipitation.  
20:49:06 Few bumps.  
20:49:09 Some flashes.  
20:49:10 Distant flash.  
20:49:42 Camera off.  
20:49:44 (Event - cell exit.)  
20:49:48 We broke out.  
20:49:53 (Data off.)  
20:49:58 Data off. End penetration 7.  
20:52:24 Negative 5° tilt.

## AIS Record 9 - Penetration 8.

20:52:50 (Data on) Data on penetration 8. 100° heading altitude 29.  
20:53:04 METRO: If you could gain a couple thousand feet it might be better for UHF. (Event - cell entry.)  
20:53:11 We're climbing to 310.  
20:53:16 Camera on.  
20:53:26 We're in the storm.  
20:53:32 Light precipitation  
20:53:34 Little turbulence.  
20:53:44 Negative 5° tilt.  
20:53:50 Pretty good precipitation.  
20:54:27 Camera off.  
20:54:48 In left turn all way round towards Gordonsville for 1 more penetration on way home.  
20:54:55 METRO: If you could go through that cell in front of you it would be fine. Put you down to 2500 lbs. If you go back you are going to be below 2500.  
20:55:14 I don't think so.  
20:55:19 I show 3900.  
20:55:21 I show 4100 on mine.  
20:56:13 Negative 5° tilt.  
20:56:18 Whats that little thing 10 miles?  
20:56:34 Back down to 290. We got something going on - on right side.  
20:56:40 Camera on.  
20:56:51 Negative 5.  
20:56:54 0° on tilt- even looks good at zero. Must be a fast grower.  
20:57:09 METRO: 816, RTB. Fuel.  
20:57:17 (Event - cell entry)  
20:57:31 (Aft camera recorded strike.)  
20:57:33 There's strike.  
20:57:35 Strike. No trigger  
20:57:42 Good precipitation.  
20:57:43 (Event - cell exit.)

20:58:11 Camera off.  
20:58:15 (Data off.)  
20:58:19 Data is off for penetration 8.  
20:59:59 Data is on for DLite calcs.

AIS Record 10 - DLite Cals.

21:00:10 (Data on.)  
21:01:29 (Data off.)

AIS Record 11 - Penetration 9.

21:13:30 (Data on.)  
21:13:31 (Event - storm entry.)  
21:14:08 (Event - storm exit.)  
21:14:15 (Data off.)

AIS Record 12 - Landing.

21:28:40 (AIS data on.)  
21:29:34 (Touchdown.)  
21:30:19 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 023 F-106B

Date June 11, 1984

Crew Brown/Winebarger

Engine Start 19 : 29 : 50

Take-off 19 : 43 : 53

Landing 21 : 29 : 34

## Lightning Systems:

Dlite 2 Triggers

10ns LeCroy I.1  $\dot{D}_F$  2  $\dot{B}_{W,L}$  3  $\dot{B}_{W,R}$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I} = X$  2  $\dot{D}_F = X$

## Non-Lightning Systems:

AIS OK

INS OK

Telemetry: Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 3 Strikes

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) OK

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Lightning damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Hagerstown, MD

Pens 9

Strikes 3

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-023

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape NU - Too farDigital dBZ Tape OKLDAR NU - Too farUHF Radar Real time onlyC-Band Tracking OKGoddard Antennas OKGSFC NUWFF NU - Too farLaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-024, June 12, 1984

Storm Flight/Chrisfield, Maryland

Neely/Rondeau

GMT

17:55:00 (Engine start.)

AIS Record 1 - Preflight.

17:59:30 (AIS on.)

18:00:07 (AIS off.)

AIS Record 2 - Liftoff.

18:29:50 (AIS on.)

18:30:00 (Liftoff.)

18:30:51 (AIS off.)

METRO: The target storm is about on the 050° radial, from Patuxent at about 30 miles. It puts it right on the edge of the restricted 4006.

The tops on that was 46000 ft, 6 flashes minute.

18:44:46 7.4 fuel.

18:45:43 METRO: Do you see target storm on your radar?

We see it in front of us.

18:46:00 I've got it 35 miles away, level 3 and 4.

18:46:13 1° down on tilt.

18:47:30 We're under the overhang right now.

18:47:43 METRO: There's a small storm to the west of you that's probably doing it.

18:47:49 Our altitude is 28.8 and heading 060°.

18:48:06 Data on. We're in the anvil.

18:48:12 Cloud entry. (Event.)

AIS Record 3 - Penetration 1.

18:48:20 (AIS and DLite data on.)

18:48:21 I show the meat of the storm about 18 miles at 10 o'clock.

18:48:58 METRO: SPANDAR advises tops of target cell 46000 ft. Level 3. 6 per minute.

18:49:06 Start losing the yellow at 14 miles. 3° down on tilt.

18:49:59 Camera on. (External camera on.)

18:50:05 Out of the storm.

18:50:43 Little precipitation.

18:50:45 Light turbulence, small amount of precipitation.

18:50:53 More turbulence, heavy rain.

18:51:07 Little bit of red in this one.

18:51:23 Strike!

18:51:24 Moderate turbulence, strike.

18:51:28 Strike to nose boom.

18:51:30 Pretty good bumps.  
18:51:32 Precipitation.  
18:51:36 Woh - ride em cowboy. Ride em storm, yeah.  
18:51:44 Turn data off.  
18:51:45 (AIS, DLite and external camera off.)  
  
18:51:48 METRO: I'd like you to 90-270° back into it.  
18:51:52 METRO: I confirm strike but no triggers.  
18:51:56 Did you get triggers?  
18:51:57 I don't know. I didn't look.  
18:52:00 We'll check that next time.  
18:52:22 That strike occurred in relatively heavy precipitation, couple pixels of red. Lot of vertical motion in this storm. Just as we came out we got a really strong downdraft.  
  
18:52:42 Do you know what heading was on that?  
18:52:45 About 080°, I'd guess.  
18:52:50 I saw a couple of flashes, cloud to ground down low.

## AIS Record 4 - Penetration #2.

18:53:33 Data on.  
18:53:34 Camera on. (External camera on.)  
18:53:35 Just about ready to go in, 28.5 on altitude, 005° on heading.  
18:53:40 Penetration 2. 28-5 altitude, 005° heading.  
18:53:50 (AIS and DLite data on. Time code stable.)  
18:54:05.2 (DLite triggers)  
18:54:06 I think we may have caught a lick or 2 of hail as we went through there.  
  
18:54:17 METRO: We see triggers. What you get?  
18:54:24 We didn't see anything, but I got triggers onboard.  
18:54:30 Just as we went in the storm, I heard a couple of clicks. Like hail. It went away real quick. Might have been associated with the triggers.  
  
18:54:43 METRO: Hail don't trigger DLite.  
18:54:48 I'm going to turn data off.  
18:54:48 (AIS, DLite and external camera off.)  
  
18:54:55 Data off.  
18:55:03 METRO: DLite bay temperature?  
18:55:05 About 85°.  
18:55:36 Send Kavouris when you can.

## AIS Record 5 - Penetration #3.

18:56:28 Data on. Penetration #3.  
18:56:30 (AIS and DLite data on. External camera on.)  
18:56:46 Cloud entry.  
18:56:53 No turbulence yet.  
18:57:25 2° of tilt. 30,000 ft, heading will be 120°. Tell them that.  
18:57:35 2° down on tilt. Little bit of yellow.  
18:57:49 METRO: I see additional storms on ahead, but I don't want you to go in them. I've got level 5 blinking in them. Want you to keep the cell you are entering.  
18:58:05 Light turbulence, light precipitation.



18:58:23 Cloud entry.  
18:58:32 Slight turbulence.  
18:58:40 Some precipitation.  
18:58:41.1 (DLite triggers. External camera records a strike.)  
18:58:43 Strike!  
18:58:44 Strike to the nose, and we got triggers.  
18:58:47 (AIS and DLite data off. External camera off.)  
  
18:58:48 Data off.  
18:59:12 How am I doing in relation to SPANDAR? What's the antenna  
slaving rate?  
18:59:18 METRO: No problem at this point.  
18:59:57 Vicki, it looks like you turned data off right at the trigger,  
while it is still dumping. You need to leave data on 20 seconds  
after.  
19:00:14 Very well defined storm. Can see all way to ground, all way  
around it.  
19:00:22 Storm 7 miles away. Coming up 12 o'clock.  
19:00:32 Penetration will be at 345°. 30,000 altitude, 300kts.  
19:00:52 2° down on tilt. Very small spots of yellow. About a 2/2 mile  
deep storm, about 5 miles wide.

## AIS Record 6 - Penetration #4.

19:01:05 Data on. (External camera on.)  
19:01:10 (AIS and DLite data on. Time code stable.)  
19:01:10 Cloud entry.  
19:01:13 Slight precipitation.  
19:01:15 Moderate turbulence.  
19:01:20 Downdraft.  
19:02:23 Turn data off.  
19:02:26 (AIS and DLite data off. External camera off.)  
19:02:28 Camera and data off.  
19:02:33 Do 90°-270° and go back.  
19:02:38 METRO: What does top look like to you? Can you tell?  
19:03:15 I really can't tell about tops where I am right now.  
19:03:28 METRO: Got 42,000 tops in storm you are working.  
19:04:17 Storm is 12 o'clock, 10 miles heading will be 110°.

## AIS Record 7 - Penetration #5.

19:04:44.7 Data on. (External camera on.)  
19:04:45 (DLite triggers and External camera records a strike.)  
19:04:47 Strike and I got triggers.  
19:04:50 (AIS and DLite data on. Time code stable.)  
19:04:59 I don't know if data was on long enough to get that one.  
19:05:02 I hope so.  
19:05:21 We're in another storm.  
19:05:28 Moderate turbulence.  
19:05:32 Nearby flash.  
19:05:38 Lot of lateral motion.  
19:05:40 Slight precipitation.  
19:05:42 Nearby flash.  
19:05:50 METRO: Flash behind.

19:06:02 (AIS and DLite data off.)  
19:06:07 Data off.  
19:06:13 METRO: We show your track about 5 miles north from center of cell. Thats how it looks on ground.  
19:06:25 We show going right through the center.  
19:06:28 METRO: So we are getting some lean.  
19:06:32 No doubt you are getting some lean. I can make the pattern shift on the radar just by changing the tilt. We are in blow off of another storm just east of the one we've been going through.  
19:07:42 METRO: Turn data on.

## AIS Record 8 - Penetration #6.

19:07:46 Data on.  
19:07:57 A lot more blow off to the south of the storm.  
19:07:13 METRO: We are seeing a lot of E<sub>y</sub> field mill. That's why I called data on. Seems to have gone back to zero, if you want to turn it off for a little bit, okay.  
19:08:00 (AIS and DLite data on. Time code stable.)  
19:08:23 Turn it off save data.  
19:08:23 (AIS and DLite data off.)  
19:08:32 Funny, we've been struck almost everytime coming through in that direction, but not in this one.  
19:08:46 29.5, heading 340°, 300 kts.

## AIS Record 9 - Penetration #7.

19:08:54 Data on.  
19:08:56 Camera on. (External camera on.)  
19:09:00 Cloud entry.  
19:09:10 (AIS and DLite data on. Time code stable.)  
19:09:18 METRO: Echo.  
19:09:20 Heavy rain. Nor, yeah.  
19:09:35 Moderate turbulence.  
19:09:46 METRO: All the lightning echos are behind you now.  
19:09:53 (AIS and DLite data off. External camera off.)  
19:09:59 Make turn to left, maybe get a better run through it.

## AIS Record 10 - Penetration #8.

19:11:32 Data is on.  
19:11:36 Cloud entry.  
19:11:50 (AIS and DLite data on. Time code stable.)  
19:11:50 3° down in tilt, 10 mile range. Good blow of yellow at 7 1/2 miles.  
19:12:05 30,000 ft, 120° heading.  
19:12:15 SPANDAR: At 135° bearing from about 15 miles we do see some level 5. Believe it to be below you somewhat.  
19:12:32 Moderate precipitation, and we're out of the storm.  
19:12:35 (AIS and DLite data off.)  
19:12:52 Big updraft.  
19:13:00 One of the strongest updrafts I've ever had. I went up about

1500 ft. per minute in between 2 cells.  
19:13:41 Another real strong updraft. I'm still going up 1500 ft per minute, and I'm almost zero g.  
19:13:54 METRO: Hang on.  
19:14:50 How many strikes we got?  
3  
19:15:42 300 kts, 020° heading, 30,300 feet.

AIS Record 11 - Penetration #9.

19:15:47 Data on.  
19:15:50 (AIS and DLite data on.)  
19:15:52 Cloud entry.  
19:16:05 Light precipitation.  
19:16:06 Light chop.  
19:16:15 I don't like that heading, go west.  
19:17:23 SPANDAR: UHF is seeing more lightning about 135° from you. You skirted the eastern edge. The lightning seems to be more on the western side.  
19:17:26 (AIS and DLite data off.)  
19:17:47 METRO: Don't transmit. We're going to send a Kavouris.  
19:19:12 METRO: You should have a new Kavouris?  
Got it.  
19:19:19 Look good to you?  
19:19:23 Looks alright. Where am I? Right there round the S.  
19:19:29 METRO: You're up there at that line at the top of the picture. Western edge of it.  
19:19:33 The good one is the one I'm not allowed to go to, right?  
19:19:36 METRO: I think we'll try it this time.  
19:20:23 I show the best storm at 12 o'clock, 18 miles.'

## AIS Record 12 - Penetration #10.

19:20:31 METRO: Affirm.  
19:21:48 Strike, I think. (AIS and DLite data on. DLite triggers. External camera on.)  
19:21:50 Strike, and I didn't have the thing on.  
19:21:53 We just got a strike without the data.  
19:21:56 (External camera records a strike.)  
19:22:00 (AIS and DLite data on. Time code stable.)  
19:22:02 We're almost, not clear air, but not much of a cloud.  
19:22:09 METRO: We think maybe you got another strike.  
19:22:10 Well, maybe.  
19:22:17 Sure good productivity in this storm on this heading.  
19:22:32 We're in clear, but just about to go right back into another storm, about 2 minutes.  
19:22:40 Heading 110°, altitude 30,000.  
19:22:51 Moderate turbulence.  
19:22:53 Moderate precipitation.  
19:22:57 Strike! A good one.  
19:22:57.5 (DLite triggers. External camera records a strike.)  
19:22:59 Got a strike. Got triggers.  
19:23:39 SPANDAR: About 145° - 150° your position, 12 miles, level 5.  
19:24:04 I sure wish we got that one we missed.

19:24:07 Don't worry, there'll be more.  
19:24:12 (I called 2 lightning bolts in it.  
19:24:16 METRO: You get a strike?  
19:24:17 Negative.  
19:24:19 Lot of convective activity. Trying to maintain 31. Somewhere  $\pm 5$  on airspeed.  
19:24:31 Heading 150°. Altitude 30,600.  
19:24:39 Nearby flashes.  
19:24:49 Moderate turbulence.  
19:24:51 Light precipitation.  
19:25:07 Heavy turbulence.  
19:25:15.8 (DLite triggers. External camera records a strike.)  
19:25:18 Strike to right wing tip, I think. Got triggers.  
19:25:30 (AIS and DLite data off. External camera off.)  
  
19:25:37 Just had triggers again.  
19:25:39 We're in the clear, data off.  
19:25:47 No - I guess maybe they were just coming back on.  
19:25:59 5 strikes.  
19:26:54 Another aircraft working in or around the storm said 45000 ft. tops.  
19:27:24 METRO: We're counting 4-6.  
19:28:10 30,000 ft, 335° on heading, 300 kts.  
19:28:16 3° down on tilt see level 3, no red pixels.  
  
AIS Record 13 - Penetration #11.  
  
19:28:19 Data on.  
19:28:25 Cloud entry. Heading 340°.  
19:28:30 (AIS and DLite data on. Time code stable.)  
19:28:40 A good storm ahead, 5 to 7 miles ahead, about 5 miles in diameter, 3 and 4, 50-50.  
19:29:06 Nearby flashes.  
19:29:10 More.  
19:29:13 Heavy rain.  
19:29:15 More nearby flashes.  
19:29:19 More nearby flashes.  
19:29:22 Again.  
19:29:50 12 miles ahead, another storm, 75% level 4.  
19:30:46 3° down on tilt, getting a little light. I show it  $2\frac{1}{2}$  miles ahead. I suspect a little attenuation of the dome on the right side. Looks like a peanut. A Virginia peanut. 30,500, 325°. We're in the storm.  
19:31:05 We're in storm. Heading 340°.  
19:31:08 Few red pixels at 12.  
19:31:12 Heavy rain.  
19:31:14 Very heavy rain.  
19:31:15 Flashes.  
(End of voice tape.)  
19:31:16 Nearby flashes.  
19:31:19 Heavy turbulence.  
19:31:38 (AIS and DLite data off.)  
  
19:31:50 We're out of the cloud.

19:32:13 Another Kavouris when you get a chance, please.  
19:33:29 METRO: You should have a new Kavouris.

## AIS Record 14 - Penetration #12.

19:33:43 Data on.  
19:33:47 Cloud entry.  
19:33:50 (AIS and DLite data on. Time code stable.)  
19:33:54 12 miles to storm at 12 o'clock. Heading 120°.   
19:34:13 2° down on tilt.  
19:34:28 3° down tilt. Altitude 30,000 ft. 115°.   
19:34:38 Only thing of note, reflectivity-wise, is occasionally, get  
right in next to it we're picking up few pixels of red.  
Real heavy precipitation.  
19:34:51 Storm entry.  
19:34:54 Light precipitation.  
19:35:01 Little heavier precipitation.  
19:35:08 Nearby flashes.  
19:35:12 Good bump.  
19:35:13 Moderate turbulence.  
19:35:15 Maybe heavy turbulence.  
19:35:23 Wow - My God.  
19:35:27 That's why your straps are tight.  
19:35:32 Scared the s\_\_\_ out of me!  
19:35:56 Another storm, 10 miles.  
19:35:58 Leave it on.  
19:36:24 Storm 12 o'clock, 7 miles, heading 170°.   
19:36:53 Nearby flashes.  
19:37:01 More nearby flash.  
19:37:04 Altitude 30,000.  
19:37:09 Light precipitation.  
19:37:12 Moderate turbulence.  
19:37:14 More nearby flashes.  
19:37:46 Cloud exit.  
19:37:47 (AIS and DLite data off.)

19:39:45 METRO: I show another 11 minutes for you. If you could get up to  
northwest, then back to northeast it probably would work out ok.  
19:39:53 That's what I plan on doing. I show 3800 now.  
19:40:00 METRO: I'm shooting for 2500 BINGO - over the field.

## AIS Record 15 - Penetration #13.

19:40:47 Cloud entry.  
19:40:53 Moderate turbulence.  
19:41:00 (AIS and DLite data on. Time code stable.)  
19:41:05 Nearby flash.  
19:41:13 Light precipitation.  
19:41:28 Moderate turbulence.  
19:41:34 More nearby flashes.  
19:41:54 Camera is out - light just came on.  
(External camera out of film.)  
19:42:52 Nearby flashes.  
19:43:00 More nearby flashes.

19:43:02 Moderate precipitation and heavy turbulence.  
19:43:25 Out of storm.  
19:43:26 (AIS and DLite data off.)  
19:44:17 METRO: Say weapons bay temperature.  
19:44:24 90°.  
19:44:42 It is really about 93°.

## AIS Record 16 - Penetration #14.

19:44:51 Data is on.  
19:45:00 (AIS and DLite data on. Time code stable.)  
19:45:06.1 (AIS LeCroy triggers. Nearby.)  
19:45:12 10 miles, 3° down. Try to do 29-5 again, 120° heading.  
19:45:23 Something is wrong with my machinery back here. There it goes.  
19:45:30 METRO: Did you just have LeCroy triggers?  
19:45:31 No, triggers have been going in and out but we weren't anywhere to get a trigger. They have been going in and out one at a time but I just got triggers that time.  
19:45:38.1 (AIS DLite LeCroy triggers. Nearby.)  
19:45:53 I don't know if I'm getting triggers.  
19:45:57 We are getting a lot of nearby flashes that are causing triggers to go crazy.  
19:46:11 Now we have 1,2 and 4 right now. 3 just came on.  
19:46:20 (AIS and DLite data off.)  
19:46:38 METRO: Keep data on.

## AIS Record 17 - Penetration 15, cal's.

19:46:50 (AIS and DLite data on.)  
19:46:59 It's falling apart. It's good timing.  
19:47:11 We're in the clouds.  
19:47:32 Very slight turbulence.  
19:47:37 Nearby flash.  
19:47:46 Slight precipitation.  
19:47:56 Moderate turbulence.  
19:48:06 We're out of the storm.  
19:48:33 METRO: Do DLite cal's.  
19:48:34 Will do.  
19:49:26 Should have been first cal.  
19:50:42 (AIS and DLite data off.)

## AIS Record 18 - Landing.

20:02:10 (AIS data on.)  
20:04:00 (Landing.)  
20:04:48 (AIS data off.)

## AIS Record 19.

20:09:30 (AIS data on.)  
20:10:45 (AIS data off.)

## AIS Record 20.

Flight 84-024

9

20:11:40 (AIS data on.)  
20:13:30 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 024 F-106B

Date June 13, 1984

Crew Neely/Rondeau

Engine Start 17:55:00 est

Take-off 18:30:00

Landing 20:04:00

Lightning Systems:

Dlite 8 Triggers

10ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{B}_{W,L}$  3  $\dot{B}_{W,R}$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP101 2  $\dot{I}_N$  3  $\dot{I}_T$

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

Aft movie camera 5 Strikes.

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) OK

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP Lightning damage

Passive protection

Diverter strips Top diverter missing  
4 buttons.

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Chrisfield, MD

Pens 15

Strikes 7

Nearbys 3



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 024

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR TNORUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-025, June 13, 1984

Storm Flight/Shenandoah, VA

Brown/Fisher

GMT

18:42:20 (Engine start.)  
18:43:00 (DLite master power on.)

AIS Record 1 - Takeoff.

18:55:40 (AIS data on.)  
18:55:53 (Takeoff.)  
18:56:40 (AIS data off.)  
19:07:53 (DLite instrumentation on.)  
19:12:42 (Voice recorder on.)  
19:12:49 (Radar video recorder on.)  
19:14:05 Weapons bay 85°.

AIS Record 2 - Pen #1.

19:15:40 (AIS & DLite data on.)  
19:15:55 Data systems on for penetration 1, FL 310, we'll be  
turning left to heading 270°.  
19:16:09 0° tilt.  
19:16:11 Underneath the anvil now.  
19:16:23 Occasional light turbulence. Still in the clear.  
19:16:30 Camera on. (External camera on.)  
19:16:43 Cloud entry, event.  
19:16:44 (Event for cloud entry.)  
19:16:49 0° tilt.  
19:16:59 Light rain, occasional light turbulence.  
19:17:10 Continuous light turbulence and light rain.  
19:17:20 Moderate bounce and moderate to heavy rain.  
19:17:23 (External camera records a strike.)  
19:17:24 Strike on left side!  
19:17:26 No triggers. I didn't hear it but I sure saw it.  
19:17:30 I did too.  
19:17:31.2 (DLite LeCroy triggers 1-4. Nearby flash.)  
19:17:32 (Angle of attack vane lost.)  
19:17:33 Moderate to heavy rain, continuous light to moderate  
turbulence.  
19:17:37 Nearby flashes and 4 triggers.  
19:17:42 Nearby overhead flashes. Heavy rain.  
19:17:45 Nearby flashes.  
19:17:50 Nearby flashes.  
19:17:51 Continuous moderate rain.  
19:17:54 Continuous light turbulence.  
19:18:05 0° tilt, still.

19:18:06 Continuous light rain.  
19:18:08 Nearby flashes.  
19:18:08 Now going to light to moderate.  
19:18:10 Good strike!  
19:18:11 No triggers.  
19:18:15 I saw it and I heard it, heard the pop.  
19:18:19 More nearby flashes.  
19:18:20 Continuous light to moderate rain and light turbulence.  
19:18:25.6 (DLite LeCroy triggers 1-4. External camera records a strike.)  
19:18:26 Another strike.  
19:18:27 Direct strike. I see triggers. Strike to right side of nose boom.  
19:18:31 Continuous light turbulence and light to moderate rain at the time.  
19:18:43 Negative 2° tilt.  
19:18:53 Light to moderate turbulence, light to moderate rain.  
19:19:10 (Discussion concerning frozen airspeed system.)  
19:19:28 Moderate to heavy rain.  
19:19:31 Continuous light to moderate turbulence.  
19:19:37 Rain falls off.  
19:19:41 Excellent bounce.  
19:19:46 Nearby flashes.  
19:19:48 Strike. I think. (Pilot.)  
19:19:50 I'm not sure about that one.  
19:19:51 It was very nearby.  
19:19:52 No triggers on that.  
19:19:57 We're going to pick up storm to left of nose.  
19:20:01 Got green and yellow.  
19:20:05 Continuous light turbulence, light rain.  
19:20:06 Updraft.  
19:20:26 Continuous light rain, light turbulence.  
19:20:48 0° tilt.  
19:20:50 All data systems still on.  
19:20:57 Camera off. (External camera off.)  
19:21:11 Heading 305° for this storm.  
19:21:35 0° tilt.  
19:21:42 Calm and dry. Getting ready for new penetration, couple of miles - green and yellow cell, heading 305°. Still same penetration.  
19:21:51 Getting darker.  
19:21:59 Camera on. (External camera on.)  
19:22:06 Getting darker, still calm and dry.  
19:22:20 Nearby flashes.  
19:22:23 Continuous light rain, light to moderate turbulence.  
19:22:27 Lots of nearby lightning.  
19:22:29 Light to moderate rain and turbulence.  
19:22:43 Rain sounds kinda solid. (Audible on tape.)  
19:22:45 Yes, it does. Small hail.  
19:22:49 We have no vanes on the nose.

19:23:07 Camera off. (External camera off.)  
19:23:38 Partial breakout.  
19:23:41 We're 185 (n.miles) from home. Metro wants us to come back.  
19:24:08 (AIS & DLite data off at cloud exit.)

## AIS Record 3 - Pen #2.

19:24:13 (Data) off and on again.  
19:24:20 (AIS & DLite data on. Time code stable.)  
19:24:36 Data systems cycled for penetration 2, FL 310, heading 150°. In the clear right now.  
19:25:13 0° tilt. All I see is green.  
19:25:19 Little yellow in there.  
19:25:24 Nice big thunderstorm here.  
19:25:52 (Event for cloud entry.)  
19:25:53 Event for cloud entry.  
19:25:55 Camera on. (External camera on.)  
19:26:00 Continuous light turbulence, light rain.  
19:26:21 Excellent updraft.  
19:26:22 Nearby flash.  
19:26:24 Going to moderate rain now.  
19:26:26 Going to moderate turbulence.  
19:26:27 Might have been a strike.  
19:26:30 No triggers.  
19:26:35 Excellent updraft. Lots of side-to-side bouncing.  
19:26:38 Lots of rain.  
19:26:41 Negatives G's.  
19:26:48 (Event for cloud exit.)  
19:26:54 (AIS & DLite data off. External camera off.)  
19:27:11 Everything was off at cloud exit.  
19:27:13 A rough ride.  
19:27:22 Lots of good vertical development in that storm  
19:28:28 METRO: WE'd like you to go 60° for 40 miles to get back to the original cell.

## AIS Record 4 - Pen #3.

19:28:47 Data systems on.  
19:29:00 (AIS & DLite data on. Time code stable.)  
19:29:02 Camera on. (External camera on.)  
19:29:08 0° tilt.  
19:29:11 Penetration 3. We're climbing back to FL 310, heading 070°. Cloud entry with event.  
19:29:16 Cloud entry with event.  
19:29:18 (Event for cloud entry.)  
19:29:25 Light rain, occasional light turbulence.  
19:29:28 Nearby.  
19:29:33 Moderate rain, light turbulence.  
19:29:41 Excellent vertical climb.  
19:29:45 Nearby.

19:29:46 Lot's of nearbys.  
19:29:49 Rain falls off to light.  
19:29:52 Nearby flash on right side.  
19:30:05.2 (DLite LeCroy triggers 1-4. External camera records a strike.  
19:30:06 Nearby flash, light to moderate rain.  
19:30:08 Light to moderate turbulence.  
19:30:09 Did you get a trigger?  
19:30:11 Yes, sir. I did.  
19:30:12 Direct strike?  
10:30:13 Yeah. Just a tiny little one ... attachment.  
19:30:17 Momentary cloud exit, event.  
19:30:19 (Event for cloud exit.)  
19:30:26 Camera off. (External camera off.)  
19:30:34 Negative 2° on tilt.  
19:31:03 Event for reentry.  
19:31:04 (Event for reentry.)  
19:31:12 Camera on. (External camera on.)  
19:31:13 Smooth and dry.  
19:31:22 Don't see much yellow now.  
19:31:25 And -2° on the tilt.  
19:31:31 Light rain, light to moderate turbulence.  
19:31:38 Lots of side-to-side motion.  
19:31:52 Lots of good vertical development, updrafts and down-drafts.  
19:32:25 Continuous light turbulence and light rain.  
19:32:31 Nearby flash.  
19:32:49 Negative 4° on tilt.  
19:33:24 Continuous light rain, occasional moderate and light to moderate turbulence.  
19:33:30 Getting darker. Continuous moderate turbulence, moderate rain.  
19:33:48 Lots of good bounces, in good climb right now - updraft.  
19:34:00 The rain and turbulence seem to fluctuate between light and moderate.  
Moderate, then drops to longer periods of light.  
19:34:52 Nearby flashes over head.  
19:35:00 Good side-to-side burst there.  
19:35:05 Moderate turbulence and light to moderate rain.  
19:35:28 Good side-to-side lurch.  
19:35:29 Nearby flash overhead.  
19:35:38 Getting dark.  
19:35:40 Over hang - breakout below.  
19:35:49 Camera off. (External camera off.)  
19:36:21 Camera on. (External camera on.)  
19:36:24 Back in clouds. Moderate rain, light to moderate turbulence.  
19:36:28 Lots of wing rock.  
19:36:32 Moderate to heavy rain.  
19:36:48 Cloud exit, event.

19:36:49 (Event for cloud exit.)  
19:36:54 Camera off. (External camera off.)  
19:36:58 Data off. (AIS & DLite data off.)

## AIS Record 5 - Pen #4.

19:38:12 Data on. Penetration 4, FL 290.  
19:38:30 (AIS & DLite data on. Time code stable.)  
19:38:35 Cloud entry - event.  
19:38:36 (Event for cloud entry.)  
19:38:41 Camera on. (External camera on.)  
19:38:43 Continuous moderate rain, light to moderate turbulence.  
19:38:49 Might be hail, at least heavy rain.  
19:38:59 Rain to light.  
19:39:00 Turbulence to nil.  
19:39:08 We'll be steadying up about 270°.  
19:39:12 Negative 4° to level on tilt.  
19:39:28 Light to moderate turbulence, light rain.  
19:39:48 Negative 2° on tilt.  
19:39:56 Light rain and light turbulence.  
19:40:00 Nearby flash overhead.  
19:40:27 Light rain and continuous light turbulence.  
19:40:52 Occasional moderate turbulence, still light rain.  
19:41:00 Direct strike, left side. Excellent channels.  
4 triggers.  
19:41:00.1 (DLite LeCroy triggers 1-4. Strike.)  
19:41:06 Right after strike went into moderate rain and light to moderate turbulence. Was calm and dry at the time.  
19:41:27 Moderate to heavy rain.  
19:41:30 Nearby flashes all around the airplane.  
19:41:33 Light to moderate turbulence.  
19:41:39 0° tilt.  
19:41:40 I see green and yellow.  
19:41:49 Camera off. (External camera off.)  
19:41:57 Moderate turbulence, light rain.  
19:42:32 Breakout left.  
19:42:37 Right on edge of line.  
19:42:44 Calm and dry.  
19:42:51 160 miles out.  
19:42:57 Calm, dry and in the clouds.  
19:43:05 Camera on. (External camera on.)  
19:43:11 Light turbulence, light rain.  
19:43:17 Getting darker, moderate rain.  
19:43:19 Direct strike! All triggers. Left side of aircraft.  
19:43:19.2 (DLite LeCroy triggers 1-4, strike.)  
19:43:23 Another strike.  
19:43:25 Triggers had not rearmed.  
19:43:28 Lots of noise on that one.  
19:43:32 Another direct strike. We still haven't rearmed. In light to moderate turbulence, moderate rain for all of those.

19:43:47 Conditions unchanged.  
19:43:48.8 (DLite LeCroy triggers 1-4. Strike.)  
19:43:49 Another good strike to left side.  
4 triggers.  
19:44:09 Rain now to light.  
19:44:14 Continuous light turbulence.  
19:44:27.2 (DLite LeCroy triggers 1-4. Strike.)  
19:44:28 Lot's of nearby flashes, and 4 triggers.  
19:44:31 Light to moderate rain, light turbulence at the time.  
19:44:35 That might have been a strike, too.  
19:44:37 Aft camera out of film.  
19:44:51 Cloud exit - event.  
19:44:54 (Event for cloud exit.)  
19:45:04 (AIS & DLite data off.)  
19:45:09 Nice run, big lightning.  
19:45:15 Very pretty stuff.

AIS Record 6 - Pen #5.

19:46:20 (AIS & DLite data on.)  
19:46:22 Data on for penetration #5, FL 290, initial heading -060°.  
19:46:32 Still in clear.  
19:47:07 Cloud entry with event. (Event.)  
19:47:10 Negative 2° on tilt.  
19:47:15 Light turbulence.  
19:47:16.6 (DLite LeCroy triggers 1-4. Strike.)  
19:47:17 Direct strike at cloud entry.  
4 triggers.  
19:47:21 Came from left side.  
19:47:22 Right side. (Pilot.)  
19:47:24 Really? Looked like from left.  
19:47:25 I didn't see it on left. May have gone accross the  
airplane. I saw it out of my right eye.  
19:47:29 I saw it over left ejection seat rail.  
19:47:31 Maybe it went across. I saw it just underneath the  
canopy. Just over the canopy rail on the right side.  
19:47:50 Occasional light turbulence, almost no rain.  
19:48:12 Negative 2° on tilt.  
19:48:16 Zero on tilt.  
19:48:20 Continuous light turbulence.  
19:48:23 Light rain  
19:48:25 -2° tilt.  
19:48:27 Into moderate rain, light turbulence.  
19:48:30 Big bump. Nearby flash.  
19:48:33 More nearby flashes.  
19:48:39 More nearby flashes. Light to moderate rain, light turbul-  
ence.  
19:48:45 Lots of nearby flashes.  
19:48:46 Was that a strike? (Pilot.)  
19:48:47 I don't think so.  
19:48:48 Real close.  
19:48:49 No triggers.

19:48:57 More nearby flashes ahead. Lots of good bounce. Left to right wing rock.  
19:49:04 Moderate turbulence, light rain.  
19:49:07 Collecting ice on windshield.  
19:49:17 Big sink. 2,000 ft/minute.  
19:49:25 Cloud exit on the right.  
19:49:29 And back in again.  
19:50:02 0° tilt.  
19:50:10 Continuous light to moderate turbulence, light rain.  
19:50:15 We see cells directly ahead at 20 miles. Do you want us to continue on for those?  
19:50:17.9 (DLite LeCroy triggers 1-4. Strike.)  
19:50:18 Direct strike to top of canopy.  
4 triggers.  
19:50:22 That one hit you on top your head, on top of your compass.  
19:50:28 I could see it behind the rail, but .....  
19:50:31 In 2,000 ft/minute climb, in light to moderate rain. Nearby flashes.  
19:50:36 Now call continuous moderate rain.  
19:50:44 Dark now.  
19:50:46 Light rain, light turbulence, nearby flash.  
19:51:09 146 (n. miles) out.  
19:51:28 Calm, dry but dark.  
19:51:32 Negative 2° on tilt.  
19:51:39 I see yellow on leading edge.  
19:51:51 Calm, dry but dark.  
19:52:21 Cloud exit to right, but look at overhang above us. That's why it is so dark.  
19:53:00 Moderate rain, light to moderate turbulence.  
19:53:03 Nearby flash.  
19:53:10 Moderate turbulence, moderate rain.  
19:53:25 (Event for cloud exit.  
19:53:26 Cloud exit, event.  
19:53:29 (AIS & DLite data off.)  
19:53:30 Data off.  
19:53:47 Bingo of 3,700 (lbs.)  
19:53:59 131 mileage.  
  
AIS Record 7 - Pen \$6.  
  
19:54:11 Data on.  
19:54:20 (AIS & DLite data on. Time code stable.)  
19:54:48 Weapons bay temp 90°.  
19:55:05 Penetration 6, FL 290, heading 185°.  
19:55:12 0° tilt.  
19:55:15 Light rain, light turbulence, nearby flash.  
19:55:30 (Comments by pilot concerning throttle sticking.)  
19:55:34 Light to moderate rain, light to moderate turbulence.



19:55:37 Excellent wing drop to left.  
19:55:41 2,000 ft/minute climb.  
19:55:50 Momentary cloud exit.  
19:56:06 In a right turn now to a heading of 240°.  
19:56:11 Continuous light to moderate turbulence, light rain.  
19:56:17 More like 260°.  
19:56:25 Negative 2° on tilt.  
19:56:26 Cloud exit on right.  
19:56:36 Back in cloud.  
19:56:44 Light rain, light to moderate turbulence, - continuous.  
19:56:49 2,000 ft/minute down draft.  
19:56:54 Continuous moderate turbulence, light rain.  
19:57:00.2 (DLite LeCroy triggers 1 - 4. Strike)  
19:57:01 Direct strike. Here comes a little bit of hail, perhaps.  
4 triggers.  
19:57:09 Coming right now to pick up that cell at 15 n. miles.  
19:57:21 Cloud exit.  
19:57:22 (Event for cloud exit.)  
19:58:35 (Event for reentry.)  
19:58:36 Event for reentry.  
19:58:43 Light rain, light turbulence.  
19:58:49 1,000 ft/minute downdraft.  
19:59:08 In a left turn to 240° heading to pick up the line.  
19:59:34 Negative 2° tilt.  
19:59:39 Calm, dry, quite bright.  
20:00:31 Nearby flash.  
20:00:33 Going into light rain, occasional light turbulence.  
20:00:38 Getting darker.  
20:00:45 Nearby flashes.  
20:00:47 Continuous light turbulence.  
20:00:49 Going to moderate rain.  
20:00:55 Lots of nearby flashes.  
20:00:57 Moderate to heavy rain.  
20:00:59 2,000 ft/minute climb. Sounds like hail.  
20:01:09 Lots of very close flashes. No triggers.  
20:01:13 Rain off to light.  
20:02:02 Continuous light turbulence, light rain.  
20:02:07 Moderate rain.  
20:02:23 Lots of nearby flashes.  
20:02:24 Light to moderate rain, light to moderate turbulence.  
20:02:28.6 (DLite LeCroy triggers 1-4. Strike.)  
20:02:29 We got struck,  
20:02:31 A direct strike. A solid one.  
4 triggers.  
20:02:34 I saw it on left side. (Observer.)  
20:02:35 I saw it on right side. (Pilot.)  
20:02:39 Just a small, real small, filament. (Pilot.)  
20:02:40 I agree with that.  
20:02:48 Cloud exit. (Event for cloud exit.)  
20:02:53 Data off. (AIS & DLite data off.)  
20:04:06 Nice, crisp - looking clouds.

## AIS Record 8 - Pen #7.

20:04:53 Data on.  
20:05:08 Zero tilt.  
20:05:10 (AIS & DLite data on. Time code stable.)  
20:05:22 Penetration 7, FL 290, heading 060°.  
20:05:40 (Survey of storm with radar on narrow scan.)  
20:05:54 Event at cloud entry.  
20:05:56 (Event for cloud entry.)  
20:05:59 Immediate light rain, light to moderate turbulence.  
20:06:08 Nearby flashes ahead.  
20:06:12 Moderate rain.  
20:06:15 Occasional heavy rain.  
20:06:16 Nearby flashes.  
20:06:17 Heard a crack in head set. No triggers.  
20:06:20 Light turbulence, but heavy rain.  
20:06:22 Nearby flashes.  
20:06:27 Nearby flashes moderate rain.  
Light turbulence.  
20:06:33 Starting a right turn to pick up the storm at 12 miles.  
20:06:43 Nearby flash.  
20:07:02 Calm and dry.  
20:07:37 Light turbulence, and light rain have started now.  
20:07:44 Nearby flash.  
20:07:47 Good moderate bump.  
20:07:50 Moderate rain.  
20:07:54 Both conditions moderate.  
20:07:57 Direct strike!  
20:07:57.7 (DLite LeCroy triggers 1-4. Strike.)  
20:07:58 Another direct strike.  
20:08:00 Heavy rain, moderate turbulence.  
20:08:02 Triggers.  
20:08:04 Continuous heavy rain.  
20:08:06 Nearby flashes.  
20:08:08 Did you get 2 strikes there?  
20:08:11 Yes. Saw and heard both.  
20:08:16 I saw those on right side.  
20:08:18 So did I.  
20:08:45 Cloud exit - event. (Event.)  
20:08:45 Data off.  
20:08:50 (AIS & DLite data off.)

## AIS Record 9 - Pen #8.

20:10:20 (AIS & DLite data on.)  
20:11:02 Data on.  
20:11:08 Penetration # 8, FL 290, 300° heading.  
20:11:15 Cloud entry - event.  
20:11:17 (Event for cloud entry.)  
20:11:22 Occasional light turbulence.  
20:11:24 Light rain.

20:11:26 Good strike! Left side.  
20:11:26.1 (DLite LeCroy triggers 1-4. Strike.)  
20:11:28 4 triggers, and I can still see out left side of airplane. That was light rain and no turbulence at that time.  
  
20:11:43 Continuous light turbulence and light rain now.  
20:11:46 Getting darker.  
20:11:56 Nearby flashes ahead.  
20:12:00 Moderate rain, light turbulence.  
20:12:03 Nearby flashes.  
20:12:04 Other conditions the same.  
20:12:24 Steady up about 240°. Same altitude.  
20:12:20 Calm and dry.  
20:13:08 Calm and dry, but getting darker.  
20:13:11 Breakout momentarily on left wingtip.  
20:13:33 Nearby flashes.  
20:13:35 Light rain and light turbulence with that.  
20:13:38 More nearby flashes.  
20:13:40 Moderate rain to heavy rain.  
(End of voice tape.)  
20:13:46 Nearby flashes.  
20:13:50 More nearby flashes.  
20:13:52 2,000 ft/minute updraft.)  
20:14:05 Moderate turbulence, moderate rain.  
20:14:07 Lots of wingdrop.  
20:14:23 3,500 ft/minute downdraft.  
20:14:37 Cloud exit.  
20:14:38 (Event for cloud exit.)  
20:14:48 Cycle data. (AIS & DLite data off.)  
20:16:01 Negative 2° tilt.

## AIS Record 10 - Penetration #9.

20:16:05 Data on.  
20:16:08 Penetration 9, FL 290, 055°.  
20:16:10 (AIS & DLite data on. Time code stable.)  
20:16:13 Cloud entry. Event.  
20:16:15 (Event for cloud entry.)  
20:16:20 Occasional light turbulence, but no rain.  
20:16:23 Nearby flash.  
20:16:31 Continuous light turbulence, light rain.  
20:16:37 Nearby flash.  
20:16:41 Lots of nearby flashes.  
20:16:44 Light rain, continuous light turbulence.  
20:16:45 Now moderate rain.  
20:16:49 Might have had strike. (Pilot.)  
20:16:52 Saw the flash.  
20:16:53 No triggers.  
20:16:55 We're in moderate rain, light turbulence. Now in continuous moderate rain.  
20:16:58 Good strike - right side, triggers.

20:16:58.4 (DLite LeCroy triggers 1-4. Strike.)  
20:17:00 (Side slip vane lost.)  
20:17:06 1500 ft/minute climb.  
20:17:11 Nearby flashes.  
20:17:14 Rain has fallen off to light.  
20:17:31 Calm and dry.  
20:18:09 Calm and dry and the temp in weapon bay has climbed to 95°.  
20:18:11 Continuous light turbulence and light rain.  
20:18:37 Continuous light rain, light to moderate turbulence.  
20:18:50 Nearby flash.  
20:18:53.2 (DLite LeCroy triggers 1-4. Strike.)  
20:18:54 Lot of close ones.  
20:18:56 A direct strike, I believe. (Observer.)  
4 triggers.  
20:19:00 Light turbulence and moderate rain at time.  
20:20:24 Still in clouds.  
20:20:38 Data staying on.  
20:22:35 (End of AIS tape.)  
20:23:05 Cloud exit.  
20:23:07 All tapes are gone. (End of both DLite tapes.)  
20:23:42 (Voice recorder off.)  
20:24:19 (Radar video recorder off.)  
20:24:32 (DLite instrumentation off. LeCroys triggering for no apparent reason.)  
20:24:55 (DLite master power off.)  
20:46:55 (Landing.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 025 F-106B

Engine Start 18:42:20

Date June 13, 1984

Take-off 18:55:53

Crew Brown/Fisher

Landing 20:46:53

## Lightning Systems:

Dlite 15 Triggers

10ns LeCroy I.1  $\overset{\cdot}{D}_F$  2  $\overset{\cdot}{B}_{W,L}$  3  $\overset{\cdot}{B}_{W,R}$

10n2 LeCroy II.1  $\overset{\cdot}{D}_T$  2  $\overset{\cdot}{I}$  3  $\overset{\cdot}{B}_L$

10ns LeCroy III.1  $\overset{\cdot}{D}_{W,R}$  2  $\overset{\cdot}{D}_{W,L}$  3  $\overset{\cdot}{D}_F$

10ns LeCroy IV.1 TP 101 2  $\overset{\cdot}{I}_N$  3  $\overset{\cdot}{I}_T$

Digital Peak Counter 1  $\overset{\cdot}{I}=X$  2  $\overset{\cdot}{D}_F=X$

## Non-Lightning Systems:

AIS Lost  $\alpha$  and  $\beta$  vanes.

INS OK

Telemetry: Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 3 Strikes

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) OK

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips Top strip lost 4 buttons  
7/8" from boom & 47 in debonded area.

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Shenandoah, VA

Pens 9

Strikes 19

Nearbys 1

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 025

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape NU - too farDigital dBZ Tape OKLDAR NU - too farUHF Radar Real time onlyC-Band Tracking OKGoddard Antennas OKGSFC NUWFF NU - too farLaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-026, June 14, 1984

Storm Flight/Washington, D.C.

Neely/Winebarger

GMT

17:59:35 Engine start.

AIS Record 1 - Takeoff.

18:12:40 (AIS data on.)

18:13:06 (Liftoff.)

18:13:44 (AIS data off.)

AIS Record 2 Pen #1.

18:32:00 We are in the storm. Data on.

18:32:16 We are heading North at 26,000.

18:32:22 Flashes and some precip.

18:32:30 Flash.

18:32:33 SPANDAR: Level 5 dead ahead.

18:32:36 Bright flashes.

18:32:43 Heavy precip and a lot of flashes.

18:33:02 METRO: You are penetrating level 5.

18:33:05 If level 5 is all like that I'll take it.

18:33:18 We have that one at 5 miles I'll take then turn right.

18:33:48 Back in next cell. Pretty good turbulence.

18:33:52 Precip moderate.

18:34:07 Out in clear.

18:34:09 METRO: I'd like you to arrange to penetrate the eastern edge of that line rather than go thru the middle as you did.

AIS Record 3 - Pen #2.

18:35:34 Back in clouds. Data on.

18:35:40 (Data on.)

18:35:43 Pen 2, altitude 26-5, heading 186°.

18:35:50 SPANDAR: Level 6 about 250°, 5 miles your position.

18:36:02 Camera on.

18:36:09 Distant flash.

18:36:13 Light precip.

18:36:18 Moderate turbulence.

18:36:23 More flashes but nothing hitting.

18:36:39 METRO: Next penetration go higher. If you can't go 29 try 31.

18:37:08 (Event - storm exit.)

18:37:12 (Data off.)

18:37:22 Data off - Pen 2.

## AIS Record 4 - Pen #3

18:38:30 (Data on.)  
18:38:41 Data on. Back in cloud. 26-5. Heading west.  
18:39:22 Cameras on.  
18:39:28 2° down on tilt.  
18:39:24 Flashes.  
18:39:37 Percip.  
18:39:41 SPANDAR: 315°- 5 miles your position, level ....  
18:39:47 Heavy percip.  
18:39:50 Lots of flashes.  
18:39:55 Pretty good turbulence, heavy precip.  
18:40:01 Lots of flashes.  
18:40:11 Strike! (All LeCroys triggered-no tape- aft camera recorded strike.)  
18:40:13 Both sides, come in right and left.  
18:40:15 That was just leaving the heavy precip.  
18:40:55 In next cell.  
18:40:57 Flashes and turbulence.  
18:40:59 Light precip.  
18:41:15 Breaking out. Real bright now.  
18:41:36 (Data off.)  
18:41:49 Data off. End of Pen #3.

## AIS Record 5 - Pen #4.

18:43:00 (Data on.)  
18:43:17 Back in blow off. Data on for Pen 4, altitude 26,000.  
In turn to right.  
18:43:30 SPANDAR: Level 5, small area level 6, 050°, 12 miles your position.  
18:43:35 (All LeCroys triggers - no tape.)  
18:43:40 Bright flash with triggers there.  
18:43:46 Without camera on.  
18:43:49 (Aft camera recorded strike.)  
18:43:51 Strike!  
18:43:52 There was a strike.  
18:44:03 Something happened to radar then.  
18:44:06 It came back.  
18:44:09 (All LeCroys triggered - no tape- aft camera recorded strike.)  
18:44:11 There was a beautiful strike on the right wing tip.  
18:44:22 SPANDAR: Level 6, 045°, 3 miles your position.  
18:44:32 That strike was in just smooth clouds, not much going at all.  
18:44:54 Back in heavy rain - flashes.  
18:45:10 Lots of flashes, heavy turbulence.  
18:46:38 SPANDAR: Level 6, 030°, 12 miles your position.  
(Breakout.)  
18:46:47 OK. By the way 030° - 12 miles is out in the open.  
18:46:56 METRO: What's your heading?  
18:46:58 045° now.



18:47:03 METRO: There are cells here, painting on my radar, in that direction.  
18:47:07 (Event - cloud entry.)  
18:47:08 There's a cell in front of me 5 miles but 12 miles is out in the clear.  
18:47:21 Back in the cell.  
18:47:28 A little red pixel in front of us.  
18:47:34 Pretty good precipitation and flashes.  
18:47:41 A little bit of slush too sounds like.  
18:47:44 (All LeCroys triggered - no tape.)  
18:48:16 SPANDAR: I show that intense storm about due west of you right now.  
18:48:18 (Event - exit.)  
18:48:37 (Data off.)  
18:48:48 SPANDAR: I gave you a missed figure while ago. Sorry about that.  
18:48:56 METRO: Sent you a Kavouris.  
18:49:33 They don't look lined up, Up here like they do on Kavouris.

## AIS Record 6 - Penetration #5.

18:50:13 Data on for Penetration 5. Still in turn at 25,000.  
18:50:20 (Data on.)  
18:50:52 METRO: You are running west on a line parallel to the one you got all the hits in before. The hottest place I know of is about 240° from your present position about 10 miles.  
18:51:09 We're going there.  
18:52:37 SPANDAR: You are still headed for level 5 area.  
18:52:55 We're back in the cell.  
18:53:00 Metro, Is this the one that's got the most activity. I am beginning to get confused as to which storm I'm in now.  
18:53:07 METRO: You're heading for original line. The one that you were in, got all the strikes in.  
18:53:08 Affirmative.  
18:53:25 Flashes.  
18:53:28 METRO: What level are you showing on your radar?  
18:53:30 3 and 4.  
18:53:32 See a lot of yellow.  
18:53:37 Light precipitation now and light turbulence.  
18:53:48 Flashes and heavy turbulence.  
18:54:00 METRO: Heading 270?  
18:54:02 Yep, going that way right now.  
18:54:44 SPANDAR: Level 5, 290°, 5 miles your position.  
18:54:58 More flashes.  
18:55:03 Moderate precipitation.  
18:55:14 (All LeCroys triggered - no tape.)  
18:55:15 Strike! On right wingtip.  
18:55:16 Triggers.  
18:55:30 Hail.

18:55:46 Great burst of slush sounding on the airplane.  
18:56:05 (Event - exit.)  
18:56:09 (Data off.)  
18:56:20 Data off, end Pen 5.  
18:56:26 METRO: Do you still have alpha vane?  
18:56:32 Alpha vane left.  
18:57:13 SPANDAR: 135°, 3 miles your position level 5.

## AIS Record 7 - Pen #6.

18:57:29 Data on for Pen 6, heading 120°, altitude 26,000.  
18:57:40 (Data on.)  
18:57:46 (Event - entry.)  
18:57:47 Back in the cloud.  
18:57:51 Camera on.  
18:58:04 Pretty heavy precip, flashes.  
18:58:30 Fairly heavy turbulence.  
18:58:33 Moderate precip.  
18:58:43 SPANDAR: 045°, 3 miles, level 5.  
18:58:45 OK. We're heading 090°.  
18:58:56 SPANDAR: Looks like you might skirt that southeastern edge of it.  
18:59:12 Flashes and moderate precip.  
18:59:16 Moderate turbulence.  
18:59:26 Pretty heavy turbulence  
19:00:47 (All LeCroys showed triggers but was circuit breaker.)  
19:00:54 (Event - exit.)  
19:00:56 (Data off.)  
19:00:59 METRO: We show triggers.  
10:01:04 We had exited the cloud and I do have triggers-  
I don't know why.  
19:01:11 METRO: Weapons bay temperature?  
19:01:13 86°. I'd turned data off.  
19:02:16 METRO: Do you see LeCroy lights back yet?  
19:02:19 Negative.  
19:02:22 METRO: That confirms what we are seeing here.  
19:02:25 Should I recycle?  
19:02:29 Carney advises recycle.  
19:02:54 Getting nothing.  
19:02:57 METRO: See if you can DLite MARS recorders on, we may have blown a circuit breaker again.  
19:03:18 METRO: Verify that MARS 1 and MARS 2 lights are on.  
19:03:22 Negative. I can't get anything to come on.

## AIS Record 8 - Pen #7.

19:03:30 (AIS data on.)  
19:03:56 SPANDAR: I show level 6 due west your position, 10 Miles.  
19:09:02 I'll go northeast edge of it.  
19:04:04 Getting lots of flashes but I don't have any DLite.

19:04:09 METRO: AIS tape on?  
19:04:11 Yes.  
19:04:14 METRO: Aft movie camera?  
19:04:18 Yes, and I got a strike just as I turned it on. (Aft camera recorded the strike.)  
(Radar changed to narrow sweep at strike and pilot wondered if that did it.)  
19:04:49 SPANDAR: Level 5, 5 miles, due west.  
19:05:00 METRO: We suggest you go all way back down to DLite including DLite master power to try and bring it back up.  
19:05:34 Heavy turbulence right now.  
19:05:49 (Event - exit.)  
19:05:50 Out in clear, so I'll recycle all the way.  
19:06:01 (AIS data off.)  
That didn't bring it back on.  
Metro, are we getting valid data, keep going, or come home?  
METRO RTB since we can't get DLite.  
Are you sure that's the right answer?  
METRO: Never sure. It just seems the reasonable thing to do.

## AIS Record 9 - Landing.

19:30:50 (AIS data on.)  
19:32:38 (Touchdown.)  
19:33:40 (AIS data off.)

## AIS Record 10 - Chocks.

19:37:40 (AIS data on.)  
19:37:56 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 026 F-106B

Date June 14, 1984

Crew Neely/Winebarger

Engine Start 17:59:35

Take-off 18:13:06

Landing 19:32:38

Lightning Systems:

Dlite INOP \*\*

LeCroy I.1 2 3

LeCroy II.1 2 3

LeCroy III.1 2 3

LeCroy IV.1 2 3

Digital Peak Counter 1 I=X 2 D<sub>F</sub>=X

\*\* C/B for C-phase popped, killing  
fiber optics. Tape recorders  
not on. No Data.

Aft movie camera 4 Strikes

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) E<sub>x</sub> INOP

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips Top strip completely  
gone.

Wire mesh OK

Stormscope Aft NI 0.5 NI

Non-Lightning Systems:

AIS Lost  $\alpha$  and  $\beta$  vanes.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Region Washington, DC

Pens 7

Strikes 5

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 026

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar Real time onlyC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots PINOPWFF Tape OK

Debrief Notes for Flight 84-027, June 14, 1984

Storm Flight/Point Lookout, Md.

Brown/Winebarger

GMT

20:57:07 Engine Start.

AIS Record 1 - Takeoff.

21:06:50 (AIS data on.)

21:07:10 (Liftoff.)

21:12:20 (AIS data off.)

21:25:06 SPANDAR: We are showing about 045° your position, 8-10 miles, level 5, occasional level 6.

AIS Record 2 - Penetration #1.

21:25:31 Data is on for penetration, heading 54°, altitude 27-8.

21:25:40 (Data on.)

21:25:42 (Event - storm entry.)

21:25:43 In the cloud.

21:25:45 Tape is running.

21:25:47 Camera on.

21:25:53 LeCroy temperature 88°.

21:26:12 Precipitation and turbulence.

21:26:16 Flashes.

21:26:26 Pretty good up and down draft.

21:26:34 Moderate precipitation.

21:26:36 More flashes.

21:26:37.7 (All LeCroys triggered.)

21:26:45 METRO: Get strike?

21:26:46 Had triggers but didn't see a strike. Lot of flashes at the time.

21:27:12 Camera off.

21:27:22 We're in turn, still in cloud so data is still on.

21:28:06 Weapons bay temperature 87°.

21:28:20 (Data off.)

AIS Record 3 - Penetration #2.

21:28:30 (Data on.)

21:30:12 Headed for Penetration 2, heading 240°, altitude 27-7.

21:30:22 Weapons bay 85°.

21:30:27 Camera on.

21:30:43 Distant flashes.

21:30:51 Very light precipitation and smooth ride.

21:31:00 Strike right side. (Aft camera recorded a strike.)

21:31:01 Strike right side and no triggers.

21:31:10 Lot of flashes. Turbulence picking up.

21:31:17 SPANDAR: Due west of you level 5, about 2 miles.  
21:31:26 More hail.  
21:31:39 Bright flashes just as we exited but didn't strike.  
21:31:43 Camera off.  
21:31:45 METRO: Lot of field mill.  
21:31:52 The last strike we took was in the smooth condition just before we hit rough part.  
21:32:17 We are staying in clouds for turn, does field mill show it worth keeping data on?  
21:32:23 METRO: Affirmative  
21:32:46 (Data off.)  
21:32:47 (Event - storm exit.)  
21:32:50 We broke out. Turned it off momentarily.  
21:33:47 Data is back on. Back in the cloud. 6 miles to go to contour.  
21:33:56 0° tilt.

## AIS Record 4 - Penetration #3 and #4.

21:34:00 (Data on.)  
21:34:07 27 altitude, heading 80.  
21:34:22 Camera on.  
21:34:24 SPANDAR: We still show some level 5 in that cell ahead of you about 3 or 4 miles.  
21:34:54 Lots of flashes.  
21:34:56.6 (All LeCroys triggered.)  
21:34:58 Turbulence and light precipitation. I saw a strike on the right wing tip. With triggers.  
21:35:12 Heavy precipitation, moderate turbulence.  
21:35:23 That strike was at entry to the heavier part.  
21:35:31 METRO: Contour entry?  
21:35:35 Entry to the turbulence and heavy precipitation.  
21:35:46 Camera off.  
21:35:48 METRO: Strike?  
21:35:55 Didn't see anything.  
21:35:58 Temperature 85°.  
21:36:48 We are still in heavy clouds in turn so data is on.  
21:38:18 Penetration 4, altitude 27-6, heading 245°.  
21:38:35 Camera on.  
21:38:44 0° tilt.  
21:39:01 Light precipitation.  
21:39:06 Turbulence picking up.  
21:39:23 (Aft camera recorded strike.)  
21:39:25 Strike - no triggers.  
21:39:30 Nice loud one.  
21:39:38 Moderate turbulence and moderate precipitation at the time.  
21:39:51 Camera off.  
21:39:34 In the turn, wispy stuff can see through. Want to leave data on?  
21:40:43 METRO: Turn data off. Field mills are flat.  
21:40:46 (Data off.)  
21:41:11 METRO: DLite people want to know where last strike attacked to airplane?  
21:41:16 I saw it on nose boom. I saw it down both side of airplane from here.

21:41:24 Mainly on right side.  
21:41:29 METRO: We're wondering why D forward did not trigger in LeCroys.  
21:41:35 I heard boom in that one.  
21:41:37 I concur.  
21:41:39 METRO: Field mills are picking up. Recommend data on.

## AIS Record 5 - Penetration #5 and #6.

21:41:42 Data on.  
21:42:00 (Data on.)  
21:42:26 0° on tilt.  
21:42:37 We're level for Penetration 5 heading 060°, altitude 27-5.  
21:42:59 Camera on.  
21:43:00 METRO: UHF advises 4 strikes per minute at 24-25K.  
21:43:20 Precipitation, moderate turbulence.  
21:43:23 Flashes.  
21:43:46 Good strike! Boy! I hope the camera got that one.  
21:43:46.9 (All LeCroys triggered and aft camera recorded strike.)  
21:43:50 A big strike, triggers on that.  
21:43:51 (Aft camera recorded a strike.)  
21:43:55 I saw quite a few filaments running down the side and a loud bang.  
21:44:00 That one was loud. Just moderate conditions at the time.  
21:44:19 Camera off.  
21:44:30 Weapon bay temperature 85°.  
21:45:51 What kind of field mills do you see here?  
21:45:56 METRO: Mostly inactive but they are non-zero. Fairly high values.  
21:46:02 We are in smooth riding cloud. Dark cloud though.  
21:46:22 METRO: We see triggers.  
21:46:25 I concur but don't know from what.  
21:46:31 Temperature 85°.  
21:46:36 Don't tell me that damn thing blew again.  
21:46:49 METRO: Are MARS 1 and MARS 2 lights on?  
21:46:51 Negative.  
21:46:55 Must be another blown circuit.  
21:47:00 METRO: Concur and RTB.  
21:47:10 We are going to complete this penetration we started.  
21:47:17 Heading 235°, altitude 24-8, Penetration 6.

21:47:53 Moderate turbulence. Moderate precipitation.  
21:47:58 Lots of flashes.  
21:48:50 Camera off.  
21:48:51 Might as well let it run.  
21:49:38 (Data off.)  
21:50:00 We're out.

## AIS Record 6 - Landing.

22:02:30 (AIS data on.)  
22:02:38 (Touch down.)  
22:05:59 (AIS data off.)



# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 027 F-106B

Date June 14, 1984

Crew Brown/Winebarger

Engine Start 20 : 57 : 07

Take-off 21 : 07 : 10

Landing 22 : 05 : 04

## Lightning Systems:

Dlite 3 Triggers\*\*\*

10ns LeCroy I.1 I<sub>D</sub>F 2 B<sub>W,L</sub> 3 B<sub>W,R</sub>

10ns LeCroy II.1 D<sub>T</sub> 2 I 3 B<sub>L</sub>

10ns LeCroy III.1 D<sub>W,R</sub> 2 D<sub>W,L</sub> 3 D<sub>F</sub>

10ns LeCroy IV.1 TP101 2 I<sub>N</sub> 3 I<sub>T</sub>

Digital Peak Counter 1 I=X 2 D<sub>F</sub>=X

\*\*\* Phase C C/B popped, killing  
fiber optics.

Aft movie camera 4 Strikes

Cockpit cameras NI

Stereo Fwd

Hass aft

Aft video

Field Mills (4) E<sub>X</sub> INOP

X-Ray NI

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips Top - NI. Rt. Side  
has attachments.

Wire mesh OK

Stormscope Aft NI 0.5 NI

## Non-Lightning Systems:

AIS No vanes.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Region Pt. Lookout MD.

Pens 6

Strikes 5

Nearbys 1

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 027

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape INOPLDAR INOPUHF Radar Real time onlyC-Band Tracking OKGoddard Antennas GSFC NUWFF OKLaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots PINOPWFF Tape OK

Debrief Notes for Flight 84-028, June 28, 1984

Storm Flight/ Franklin, VA

Brown/Fisher

GMT

(Abort initial attempt to fly. Primary altitude gyro failed.)

16:23:29 (Engine restart.)

16:25:00 (DLite master power on.)

AIS Record 2 - Takeoff.

16:35:40 (AIS data on.)

16:36:25 (Takeoff.)

16:37:04 (AIS data off.)

16:40:38 (Cockpit voice recorder on.)

16:41:10 (Radar video recorder on.)

16:41:16 SPANDAR: We have a large area of level 5. The northern edge is due west your position about 15 miles. Goes a little west of south for about 20-25 miles, ending up in level 6, your position 215°, about 35 miles. (Radar scan.)

16:41:44 METRO: Volens is showing level 6 about 20-25 miles from you.

16:41:51 We copy both calls, and are scanning both storms with the radar.

16:42:01 METRO: Volens is showing level 5 along that whole line. I don't want you to go down the whole line.

16:42:12 We copy you don't want us to fly the line. We'll pick particular cells.

16:42:21 (DLite instrumentation on.)

AIS Record 3 - Pen #1.

16:43:00 Data on.

16:43:10 (AIS & DLite data on. Time code stable.)

16:43:30 FL 260 to 290, heading 240°.

16:43:34 Everything on but Aft Millikan.

16:43:44 SPANDAR: We show level 5 due west your position, about 2 miles. I believe it to be below you. Also, level 5, 315° your position, 5 miles.

16:44:11 Light turbulence.

16:44:43 Nearby flash.

16:44:47 Aft camera on. (External movie camera on.)

16:44:53 Very bright in the storm. No rain yet, and occasional light turbulence.

16:45:24 Nearby flashes ahead.

16:45:27 Level at 29,000 ft.

16:45:29 Good strike!  
16:45:29.3 (DLite Lecroy 2-4 trigger. External movie camera and cockpit vidio record a strike.)  
16:45:30 Direct strike - 4 triggers.  
16:45:34 Good one to the boom.  
16:45:40 Nearby flash on the left side.  
16:45:53 Nearby flash.  
16:46:02 Light to moderate rain.  
16:46:04 Nearby flash.  
16:46:08 In light turbulence and almost no rain at the time of the strike.  
16:46:40 (Cloud exit, event. (Event.)  
16:46:41 METRO: UHF advises 31,000 ft would probabley be best altitude.  
16:46:49 Camera off. (External movie camera off.)  
16:46:52 Data off. (AIS & DLite data off.)  
16:46:53 Going to take picture out here.  
16:46:59 Another one.  
Another one.  
16:47:20 Stormscope is showing nothing. I wonder if it is installed.  
16:47:38 METRO: Stormscope is inoperative.

## AIS Record 4 - Pen #2.

16:48:09 Getting close to cloud. Data systems on.  
16:48:20 (AIS & DLite data on. Time code stable.)  
16:48:21 Pen #2, 31,000 ft.  
17:48:45 (Radar scan.)  
16:48:50 (Event for cloud entry. )  
16:48:57 Event for cloud entry.  
16:49:03 Heading 030°.  
16:49:07 -2° tilt.  
16:49:10 Nearby flashes ahead.  
16:49:17 Camera on. (External movie camera on.)  
16:49:26 Calm and dry.  
16:49:28 A little bit of light rain.  
16:49:36 SPANDAR: About 030° your position, 15 miles, there are some level 5.  
16:49:50 -3° tilt, green and yellow.  
16:49:55 SPANDAR: About 060°, 15 miles, also show level 6.  
16:49:59 Nearby flashes.  
16:50:01 Light rain, occasional light turbulence.  
16:50:05 Clouds are darker this penetration.  
16:50:07 Metro, say winds aloft.  
16:50:14 Continuous light rain and turbulence.  
16:50:20 Nearby flashes.  
16:50:37 METRO: 240° at 45 knots.  
16:50:45 (Radar scan.)  
16:50:55 Conditions unchanged.  
16:51:08 Nearby flashes.

16:51:09 Light to moderate rain, continuous light turbulence.  
16:51:17 We see green on the radar at this location.  
16:51:19 Continuous moderate rain.  
16:51:23 Nearby flash.  
16:51:28 Little high 31,5 (Kft).  
16:51:39 Rain died off to light, and continuous light turbulence.  
16:51:45 Nearby flash.  
16:51:46 Nearby flash.  
16:51:54 Moderate turbulence.  
16:51:55 Strike to aircraft, 4 triggers.  
16:51:55.2 (DLite LeCroys triggers 2-4. External movie camera records a strike.)  
16:52:00 Strike to left side of nose.  
16:52:05 I could see the filament on that one.  
16:52:06 I could, too. Real well defined.  
16:52:10 Lot of down draft.  
16:52:11 METRO: Confirm 4 triggers.  
16:52:14 I saw 4 triggers, but trigger one is coming back very, very early. Rearming much earlier than the other 3.  
16:52:22 Some real strong updrafts and downdrafts in that one.  
16:52:28 Right after the strike some very strong up and down drafts. Conditions were both moderate at the time of the strike.  
16:52:34 Actually, the downdrafts were prior. Then we must have got some strong updrafts. When I looked, we had climbed 1,000 ft.  
16:53:11 (Radar scan.)  
16:53:21 Light rain, light turbulence.  
16:53:25 Small green cell about 4 miles dead ahead, on heading of 050°.  
16:53:32 Some good up and down drafts.  
16:53:43 Everything is on.  
16:54:05 Camera off. (External movie camera off.)  
16:54:10 Cloud exit - event.  
16:54:11 (Event for cloud exit.)  
16:54:23 Data off.  
16:54:32 (AIS and DLite data off.)

## AIS Record 5 - Penetration #3.

16:55:37 Data systems on.  
16:55:40 (AIS and DLite data on.)  
16:55:41 -2° tilt.  
16:56:20 Camera on. (External movie camera on.)  
16:56:21 Penetration #3, FL 300, Heading 210°.  
16:56:33 Light rain, occasional light turbulence.  
16:56:57 Few distant flashes with my call.  
16:56:51 Light to moderate rain and continuous light turbulence.  
16:57:01 2,000 ft/minute climb.  
16:57:06 Clouds are very bright.  
16:57:16 (Radar scan.)  
16:57:44 Continuous light turbulence and light rain.

16:57:50 Camera off. (External movie camera off.)  
16:58:07 Almost no rain now, and occasional light turbulence.  
16:58:15 Camera on. (External movie camera on.)  
16:58:18 As we come into cell - nearby flash, continuous light rain, continuous light turbulence.  
16:58:26 Moderate turbulence, occasionally, and moderate rain-continuous.  
16:58:30 Nearby flashes quite close.  
16:58:35 2,000 ft/minute climb.  
16:58:37 Nearby flashes.  
16:58:42 Rain to light.  
16:59:06 2,000 ft/minute climb rate again.  
16:59:19 Nearby flash.  
16:59:21 Both conditions are light.  
16:59:30 Nearby flashes overhead.  
Static in the headset.  
16:59:41 Camera off. (External movie camera off.)  
17:00:05 Nearby flash in the turn.  
17:00:06 Data still on.  
17:00:26 Metro, is this the most interesting cell you have?  
17:00:34 METRO: I'm wondering. Have to talk to Wallops. Continue to work this until we come up with something different.  
17:01:13 Cycle data for new penetration. (AIS & DLite data off.)

AIS Record 6 - Pen #4, FL 300, North.

17:01:18 (Radar scan.)  
17:01:30 (AIS & DLite data on.)  
17:01:31 Light rain and turbulence and lots of nearby flashes.  
17:01:37 Camera on. (External movie camera on.)  
17:01:41 Nearby flashes.  
17:01:42 Other conditions unchanged.  
17:01:51 Nearby flashes.  
17:01:52 SPANDAR: Level 5 - 340° your position about 10 miles. Believe it below you.  
17:02:00 That is the peak activity we see onboard. We're in light to moderate rain.  
17:02:06 And nearby flashes.  
17:02:09 It shows yellow on our radar rather than red.  
17:02:13 (Radar scan.)  
17:02:25 1000 ft/minute descent  
17:02:35 Good bounce and immediately we go to moderate rain.  
17:02:37 Nearby flashes.  
17:02:44 Light to moderate turbulence and continuous moderate rain.  
17:02:52 2,000 ft/minute climb.  
17:03:00 Nearby flashes and the rain has gone to light.  
17:03:02 Turbulence - light.  
17:03:11 We might need to be higher. The flashes seem to have been above.  
17:03:27 Both conditions light.

17:03:42 Camera off. (External movie camera off.)  
17:03:58 Data systems staying on in the clouds.  
17:05:18 METRO: Carney request you run calibrate sequence as soon as possible.  
17:05:28 Let me cycle data off and on, and I'll do it.  
17:05:30 (AIS & DLite data off.)  
  
AIS Record 7 - Pen #5, FL 300, South.  
  
17:05:41 Cycle data for Pen #5. We'll do cal as we come around.  
Bumpy thru here. Maybe we should hold off.  
17:05:50 (AIS & DLite data on.)  
17:05:57 Gradually climbing up to FL 310.  
17:06:12 We're flying about due south.  
17:06:16 METRO VHF advise 29K instead of 33K.  
17:06:32 (Radar scan.)  
17:07:04 Camera on. (External movie camera on.)  
17:07:06 Light to moderate turbulence, light rain.  
17:07:10 29,000 ft.  
17:07:14 Nearby flashes.  
17:07:15 Rain going to moderate.  
17:07:20 I don't see any rain on windshield.  
17:07:22 There's a little bit, now.  
17:07:24 Little bit of what?  
17:07:25 Rain.  
17:07:29 Very close flash. We are in moderate rain now.  
17:07:33 Another nearby flash.  
17:07:36 Light turbulence; moderate rain.  
17:07:45 Rain goes to light with a nearby flash.  
17:07:58 Light to moderate turbulence through here, but only light rain  
17:08:10 Nearby flash; light rain; light turbulence.  
17:08:34 -2° on tilt. Only green.  
17:08:41 -5°. Some yellow.  
17:08:58 Camera off. (External movie camera off.)  
17:09:06 In between cells, still in clouds. Occasional light turbulence and very light rain.  
17:09:24 Calm and dry.  
17:09:39 Turbulence going to light to moderate, and very light rain.  
17:09:56 Cloud exit. (Event for cloud exit.)  
17:10:15 Keep data on. Hold off on cals.  
17:10:44 Breakout straight above us.  
17:11:12 Reentry. (Event for reentry.)  
17:11:19 Camera on. (External movie camera on.)  
17:11:20 Nearby flash.  
17:11:23 Strike, I believe. Yes. 4 triggers.  
17:11:23:1 (DLite LeCrois triggers 2-4. Cockpit video records a strike.)  
Now I see only 3 triggers. May have lost LeCroy 1.  
17:11:31 Light turbulence and light rain at the time .....?  
17:11:33 Another strike! (External movie camera and cockpit

video records a strike.)  
17:11:35 That was a good one.  
17:11:36 Light turbulence and light rain at that time.  
17:11:39 Second strike. Came from the right.  
17:11:43 LeCroy triggers are back. They missed the 2nd one because they were still dumping.  
17:11:49 Cloud exit.  
17:11:50 Event. (Event for cloud exit. )  
17:11:55 Funny we got struck so close to edge of storm on that one.  
17:12:01 Keep data on.  
17:12:02 Take a picture over left shoulder.  
17:12:10 Now.  
17:12:14 METRO: Would you please try to recycle DLite instrument power switch one time for me?  
17:12:32 (AIS & DLite data off.)  
17:12:33 Data systems are off.  
17:12:36 Recycle instrumentation.  
17:12:57 Instrumentation power off to DLite . (DLite instrumentation off.)  
17:13:10 DLite back up again. (DLite instrumentation on.)  
17:13:35 Bring data on.

## AIS Record 8 - Pen #6, FL 300, 040°

17:13:40 (AIS & DLite data on.)  
17:14:03 Moderate turbulence and light rain now.  
17:14:05 Pen #6, FL 290.  
17:14:11 Camera on. (External movie camera on.)  
17:14:15 Calm and dry.  
17:14:20 Didn't see any nearbys.  
17:14:35 (Event for cloud exit.)  
17:14:39 Camera off. (External movie camera off.)  
17:14:40 Momentary cloud exit.  
17:14:50 Camera on. (External movie camera on.)  
17:14:57 Cloud entry. (Event for reentry.)  
17:15:02 Nearby flash.  
17:15:04 A little bump of moderate turbulence.  
17:15:06 Very light rain..  
17:15:10 METRO: UHF Confirms 29 to 31. Best altitute.  
17:15:18 Continuous light rain.  
17:15:19 Very light turbulence.  
17:15:30 Going to make a right turn to pick up the cell at 10 miles. Green and yellow.  
17:15:33 -5° on tilt.  
17:15:57 Camera off. (External movie camera off.)  
17:16:03 Partial breakout left.  
17:16:22 Camera on. (External movie camera on.)  
17:16:29 Moderate turbulence and light rain.  
17:16:36 Strong updraft.  
17:16:38 About 1,000 ft/minute.



17:16:39 Now 2,000.  
17:16:40 Now 3,000.  
17:16:44 Looks like some frozen stuff on the windshield.  
17:16:47 Light to moderate rain.  
17:16:50 Lots of up and down drafts.  
17:16:57 I'm countering those updrafts by pushing the nose over.  
17:17:33 Camera off. (External movie camera off.)  
17:18:06 33 n. mi. out.  
17:18:54 Camera on. (External movie camera on.)  
17:19:05 SPANDAR: I show level 5, about 015°, 10 miles your position. Believe below you.  
17:19:20 Nearby flashes.  
17:19:22 Light rain, light turbulence.  
17:19:29 Aft camera is out of film. (External movie camera out of film.)  
17:19:42 Nearby flashes.  
17:19:57 Starting a turn to the left.  
17:20:14 Light to moderate turbulence in the turn, light rain.  
17:20:20 I'd call this pretty solid moderate that we've been feeling.  
17:20:29 Nearby flashes.  
17:20:49 Weapons bay temp 85°.  
17:22:09 METRO: What just happened?  
17:22:13 Nothing that we know of.  
17:22:15 METRO: We show a big field mill excursion.  
17:22:20 Nearby flashes.  
17:22:27 There's a strike, I think.  
17:22:27.7 (DLite LeCroys triggers 1-4, strike.  
17:22:30 Yes sir. 4 triggers.  
17:22:48 Moderate rain.  
17:22:49 Direct strike. (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
17:22:51 Four triggers.  
17:22:58 Excellent turbulence thru there. Moderate.  
17:23:30 -3° tilt for long time. Back to 0° on tilt.  
17:24:31 (Discussion concerning frozen pitot static system.  
17:24:44 In moderate turbulence now, light rain.  
17:24:51 Lot of sustained turbulence today.  
17:25:30 Big downdraft we've just been flying through. Almost 3,000 ft/minute.  
17:26:05 -2° on tilt. About 5 miles before we get to the return.  
17:26:11 -5° on tilt now. Little bit of yellow.  
17:26:12 (AIS & DLite data off.)

## AIS Record 9 - Pen #7.

17:26:27 Cycle data for Pen #7, heading 280°, FL 290.  
17:26:30 (AIS & DLite data on.)  
17:26:36 Metro, what's your out look there? Looks like we're getting pretty close to Langley.

17:26:40 METRO: We are watching, and will give you an update in just a few minutes.  
17:26:46 Moderate turbulence, light rain.  
17:26:48 A nearby flashes about 10 seconds ago.  
17:27:53 Nearby flashes all around.  
17:27:01 Nearby flashes, light rain, light to moderate turbulence.  
17:27:05 Updraft.  
17:27:18 Moderate rain.  
17:27:27 Continuous moderate turbulence and light to moderate rain.  
17:27:39 Light turbulence, light rain.  
17:27:51 Light rain. Continuous moderate turbulence.  
17:28:00 Nearby flash.  
17:28:25 Nearby flash.  
17:28:59 In clouds. Will keep data systems up until you roll out, then cycle them.  
17:29:33 Smooth and dry as we come around.  
17:30:58 -5° on tilt.  
17:31:13 METRO: When you make this run, keep on coming for home.  
17:31:23 (AIS and DLite data off.)

## AIS Record 10 - Penetration #8.

17:31:31 Penetration #8, heading east, FL 290°.  
17:31:36 -2° from -5° tilt.  
17:31:39 0° tilt.  
17:31:40 (AIS & DLite data on.)  
17:31:49 Light turbulence, light rain.  
17:32:13 SPANDAR: 060° your position, about 12 miles, level 5.  
17:32:25 In continuous light rain and light to moderate turbulence.  
17:32:34 1,000 ft/minute climb.  
17:32:43 Nearby flashes overhead.  
17:32:52 Moderate turbulence, light rain.  
17:32:58 Both are moderate.  
17:32:59 Very close flash.  
17:33:05 Close flash. Moderate turbulence, moderate, maybe heavy, rain.  
17:33:19 2,000 ft/minute updraft.  
17:33:21 METRO: 816 - RTB.  
17:35:24 816 is Calling LeCroys.  
17:35:28 (Two sets of DLite LeCroy calcs.)  
17:36:25 METRO: You might want to keep data on until you land.  
17:36:29 We only have about 5 minutes left.  
17:36:40 (AIS & DLite data off.)  
17:38:36 (Cockpit voice recorder off.)  
17:38:43 (Radar video recorder off.)  
17:40:44 (DLite instrumentation off.)  
17:41:06 (DLite master power off.)

## AIS Record 11 - Landing.

Flight 84-028

9

17:56:00 (AIS data on.)  
17:56:55 (Landing.)  
17:57:36 (AIS data off.)

AIS Record 12 - Chocks.

18:05:00 (AIS data on.)  
18:06:05 (AIS data off. AIS tape runs out.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 028 F-106B

Date June 28, 1984

Crew Brown/Fisher

Engine Start 16 : 23 : 29

Take-off 16 : 36 : 25

Landing 17 : 56 : 55

Lightning Systems:

Dlite 5 Triggers\*\*\*

LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP100 2 TP101 3 TP102

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

\*\*\* LeCroy #1 INOP on first three strikes.

Non-Lightning Systems:

AIS OK

INS OK

Telemetry: Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 3 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 4 Strikes (4W/Visible channels)

Field Mills (4)  $E_X$  INOP

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Strike damage

Passive protection

Diverter strips Nick on rt. side on #1 strip.

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Franklin, VA

Pens 8

Strikes 6

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 028

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ OK \_\_\_\_\_

LDAR \_\_\_\_\_ INOP \_\_\_\_\_

UHF Radar \_\_\_\_\_ Real time only \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ OK \_\_\_\_\_

LaRC \_\_\_\_\_ NI \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NI \_\_\_\_\_

LLP \_\_\_\_\_ PINOP \_\_\_\_\_

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ PINOP \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

Debrief Notes for Flight 84-029, June 29, 1984

Storm Flight/ Manteo, N.C.

Brown/Winebarger

GMT

AIS Record 1 - Ramp Check.

19:51:50 (AIS data on)  
19:52:12 (AIS data off)  
19:55:20 (Engint start)

AIS Record 2 - Takeoff

20:09:10 (AIS data on)  
20:09:10 (Liftoff)  
20:09:49 (AIS data off)

AIS Record 3 - Penetration 1.

20:22:44 Bring data on.  
20:22:52 (Event - storm entry.)  
20:23:00 (Data on.)  
20:23:30 What altitude do you recommend, Metro?  
20:23:37 METRO: Just asking UHF for update.  
20:23:47 SPANDAR: The most intense I see is level 2 due west your position 15 miles.  
20:24:06 We're in just clouds heading east at 28,000 ft.  
20:24:59 (Event - storm exit. )  
20:25:02 We're out. Data coming off.  
20:25:03 (Data off.)  
20:25:53 Metro, we're in thin clouds, do field mills show it worth having data on?  
20:26:04 METRO: You can leave data off for a little bit.  
20:26:22 METRO: Can you see a line on your radar?  
20:26:27 Yes, I can. Have to look down to see it.  
20:26:36 -5° about 12 miles looks best and it's not very good.  
20:26:52 Hard to know what to aim at, isn't it?  
20:26:56 It's ground return attenuated by the boom, I'm looking down so much. What we see in the gap is the best we are going to see. I'm afraid.  
(Radar Scan.)

AIS Record 4 - Penetration 2.

20:27:20 (Data on.)  
20:27:23 Data on for 2nd penetration. Heading 260° altitude 24.  
20:27:40 Metro, Is there any electrical activity, that is cloud to cloud lightning?

20:27:59 This is a real bright cloud with an occasional bump.  
20:28:04 SPANDAR: The most intense due west your position, 10 miles.  
Level 2 - to us.  
20:28:30 Momentary breakout.  
20:28:50 METRO: Are you getting any precip?  
20:28:54 Very light and very light turbulence. The first time we've  
had any turbulence to speak of.  
20:29:03 Turn on the camera.  
20:29:05 METRO: Very low field mill, nothing estatic.  
20:29:11 Turn it off then.  
20:29:16 METRO: Field mill picking up a bit.  
20:29:21 You are in best area right now.  
20:29:25 That's not very good.  
20:29:29 METRO: Try harder.  
20:30:04 -7° on tilt.  
20:30:46 Stuff just went away.  
20:31:06 Turn fuselage camera on.  
20:31:10.5 (All LeCroys triggered and cockpit video recorded strike.)  
20:31:11 A good one.  
20:31:12 Got a strike!  
20:31:17 I hope movie camera was running. I had just turned it on.  
20:31:23 (Event - storm exit.)  
20:31:29 (Data off.)  
20:31:33 METRO: Say conditions at time of strike for logging purposes.  
20:31:38 Smooth clouds. Nothing going on. No rain, no turbulence.

## AIS Record 5 - Penetration 3.

20:33:40 (Data on.) Back in some thin cloud. Data is on. Heading  
75° altitude 24,000 ft. Penetration 3.  
20:34:09 -7° tilt.  
20:34:14 Camera on.  
20:34:24 Getting some turbulence this time.  
20:34:27 METRO: We see some field mill.  
20:34:29 A little precip.  
20:34:49 Camera off.  
20:35:24 SPANDAR: 12 miles a level 5, slightly below you.  
20:36:19 Metro, what flash rate, if any, do you see along this line?  
20:36:24 You're making them.  
20:36:28 No natural lightning. You are making them.  
20:36:32 (Event - cell entry.)  
20:36:34 Camera on.  
20:36:36 Percip this time.  
20:36:44 Light turbulence.  
20:36:47 Pretty good updrapfts here.  
20:37:07 (Event - cell exit.)  
20:37:10 We're out.  
20:37:11 The only flash I've seen is the one that hit us.  
20:37:33 Weapons bay 84°, steady.  
20:37:40 According to my calculations you couldn't go below 20,000 ft.  
before wallops would lose you.

20:37:58 The instrumentation has only been on for 12 minutes.  
That's not long enough to heating anyway.  
20:39:14 (Data off.)  
  
AIS Record 6 - Penetration 4.  
20:39:50 (Data on.)  
20:39:53 In turn in the clouds, getting a little turbulence.  
20:39:59 Camera is on.  
20:40:04 METRO: We show a storm about 260° from your present position.  
20:40:13 We do too, but we're going to pick up this little one just  
ahead of us before we penetrate that one.  
20:40:30 Moderate turbulence in this.  
20:40:35 Light rain.  
20:40:46 (Event - cell exit.)  
20:40:53 Camera off.  
20:40:54 METRO: Showing any flashes?  
20:40:56 Negative flashes.  
20:42:11 Penetration 4. Headed 310°, altitude 24,000 ft.  
20:42:32 Camera on.  
20:42:49 Light turbulence.  
20:42:50 Light precip.  
20:42:52 Heavier rain now.  
20:43:00 METRO: Showing field mills.  
20:43:27 Camera off.  
20:43:32 (Event - cell exit.)  
20:43:34 (Data off.)  
20:43:36 Metro, what's bearing and distance to best return?  
20:43:42 METRO: 320°, 10 miles.

## AIS Record 7 - Penetration 5

20:44:50 Data on.  
20:45:07 Camera on.  
20:45:10 (Data on.)  
20:45:17 Bay temp 85°.  
20:45:29 Very good turbulence.  
20:45:31 Heavy precip and we're out.  
20:45:39 (Event - cell exit.)  
20:45:39 (Data off.)  
20:46:11 That was penetration 5.

## AIS Record 8 - Penetration 6.

20:47:20 (Data on. Event - cell entry.)  
20:47:21 Turbulence and heavy precip on entering the storm.  
20:47:25 At 20,000 ft. Turning back to 90°.  
20:47:46 Camera off.  
20:47:48 -5° tilt.  
20:48:02 -2°. Still got a little something. 070° for this cell.  
20:48:22 SPANDAR: We show level 5 about 10 miles 060° your position.  
20:48:30 That's where we are headed. We show only a little dot of yellow.



20:48:35 Negative 2, here's negative 5°. See a little bit more yellow.  
20:48:45 -7° same, back to -5°.   
20:49:02 Weapons bay 86°.   
20:49:08 Camera on.   
20:49:22 In cell now. Getting some turbulence.   
20:49:28 Some precip.   
20:49:35 Distant flash.   
20:49:44 Updraft.   
20:50:17 Camera off.   
20:50:54 Precip, pretty heavy precip now.   
20:51:01 Camera off.   
20:51:09 (Data off. )   
20:51:30 Metro, do you have any cells better than these?   
20:51:34 METRO: No sir, you are playing around with the hottest thing around.   
20:51:39 METRO: You need to go up?   
20:51:44 How far?   
20:51:47 METRO: 27-28.   
20:51:51 We have to look down to see things here.

## AIS Record 9 - Penetration 7.

20:52:26 Penetration 7. Data is on. We're in the clouds.   
20:53:30 (Data on.)   
20:53:20 Camera on.   
20:53:36 We're in again heading 290° and climbing.   
20:53:52 Light turbulence.   
20:53:52.3 (All LeCroys triggered, Aft camera and cockpit video recorded strike.)   
20:53:53 Strike! Left side.   
20:53:57 We were struck at 230.   
20:54:00 Strike, very light precip and very light turbulence.   
20:54:17 Camera off.   
20:54:25 (Event-exit.)   
20:54:28 (Data off.)

## AIS Record 10 - Penetration 8.

20:57:09 Data on for penetration 8. Heading 110°, altitude 25,000 ft.   
20:57:20 (Data on.) -5° tilt.   
20:57:26 (Event - storm entry.   
20:57:30 Getting some light turbulence.   
20:57:34 Camera on.   
20:57:42 Updraft.   
20:58:26 Camera off.   
20:58:45 -6° tilt.   
20:59:15 (Data off.)   
(Radar Scan.)

## AIS Record 11 - Penetration 9.

21:00:29 In the cloud, data is on for penetration 9.  
21:00:30 (Data on.)  
21:00:35 -4 on tilt. In left turn.  
21:01:22 Altitude 24-5 and heading 240°.  
21:01:28 Camera on.  
21:01:36 Updraft.  
21:02:00 METRO: UHF reports lightning in your vicinity. What do you see?  
21:02:04 Nothing.  
21:02:06 Camera off.  
21:03:03 Metro, do you see any field mill activity that I should have data on in these clouds?  
21:03:05 METRO: Negative.  
21:03:08 (Data off.)  
21:05:33 -4° tilt.

## AIS Record 12 - Penetration 10.

21:05:43 Data on.  
21:05:50 (Data on.)  
21:05:58 -5° now.  
21:06:06 Camera on.  
21:06:10 We're in cell. Heading 260° altitude 25,000 ft.  
21:06:30 Light turbulence.  
21:06:57 Some light precip.  
21:07:02 Camera off. (Event - cell exit.)  
21:07:04 We're out.  
21:07:06 (Data off.)  
21:07:08 That was penetration 10.

## AIS Record 13 - Penetration 11.

21:08:29 Data on.  
21:08:50 (Data on.)  
21:09:17 Camera on.  
21:09:21 Back in cell.  
21:09:23 Light precip, light turbulence.  
21:09:46 Camera off.  
21:09:53 (Data off.)  
21:10:55 -4°.  
21:11:01 -5°.  
21:11:26 SPANDAR: A small area of level 4, 300° your position, 10 miles..  
21:11:34 Must be what we just flew thru.  
21:11:40 SPANDAR: Yeah you went just barely to the south of it. A very small dot.  
21:11:49 -7° now.  
21:12:37 Weapons bay is up to 92°.

## AIS Record 14 - Penetration 12 (Cloud record).

21:13:01 Data on.  
21:13:10 (Data on.)  
21:13:20 Don't have enough on radar to know where the cell is so brought data on for penetration 12. Heading 70° altitude 25,000 ft.  
21:14:02 METRO: Heaviest reflectivity is now at west end of the line.  
21:14:11 We concur.  
21:14:33 (Data off.)  
21:14:52 We didn't find anything to call a cell on that penetration.  
21:15:05 -2°.  
21:15:25 SPANDAR: The only intensity we see now about 135° your position, 20 miles. That's level 2 for us. The rest is level one and below.  
21:15:41 We agree. We are heading for the one to the west.  
21:16:41 -2° on tilt.

## AIS Record 15 - Penetration 13.

21:16:50 (Data on.)  
21:17:10 Data on for penetration 13. We're in the clouds. 255° heading altitude 25,000 ft.  
21:17:13 (Event - cell entry.)  
21:17:29 METRO: UHF lightning ahead.  
21:17:38 Camera on.  
21:17:54 -5° on tilt.  
21:17:57 Getting some light turbulence thru this.  
21:18:16 Pretty good chop here now.  
21:18:19 Light precip.  
21:18:47 Updraft.  
21:18:54 This is about the bumpiest we've seen.  
21:18:57 Light precip now.  
21:19:04 Camera off.  
21:19:09 -2° on tilt.  
21:19:33 METRO: Fuel state?  
21:19:36 3.9  
21:19:41 Just hit 95° point on DiLite.  
21:19:55 Take a picture.  
21:20:04 (Data off.)  
21:20:37 METRO: DiLite technician advises shut down and might as well come home.  
21:20:44 Another picture.  
21:20:47 Shutting down DiLite.

## Camera Only - Penetration 14.

21:21:30 Camera on.  
21:22:05 (Aft camera recorded strike.)  
21:22:06 Good strike!  
21:22:07 Strike with no data but camera was on.

21:22:46 Moderate turbulence and light precip at strike - altitude  
23,000 ft.

21:23:00 (End penetration.)

AIS Record 17 - Landing.

21:35:10 (AIS data on.)

21:36:44 (Touchdown.)

21:37:43 (AIS data off.)

AIS Record 18 -Chocks-

21:42:40 (AIS data on.)

21:43:40 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 029 F-106B

Engine Start 19 : 55 : 20

Date June 29, 1984

Take-off 20 : 09 : 14

Crew Brown/Winebarger

Landing 21 : 30 : 44

Lightning Systems:

Dlite 2 triggers

40ns LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP100 2 TP101 3 TP102

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

Non-Lightning Systems:

AIS No vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 2 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 2 strikes

Field Mills (4)  $\dot{E}_X$  INOP PINOP

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Manteo, NC

Pens 13

Strikes 3

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84-029

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape PINOPLDAR INOPUHF Radar Real time only.C-Band Tracking OKGoddard Antennas OKGSFC NUWFF NULaRC NIELF Antenna NILLP PINOP (Dahlgren down.)WFF Plots OKLaRC Plots PINOPWFF Tape OK

Debrief Notes for Flight 84-030, July 2, 1984

Storm Flight/Swanquarter, NC

Neely/Fisher

GMT

17:52:30 (Engine start.)  
17:56:55 (DLite master power on.)

AIS Record 2 - Takeoff.

18:03:00 (AIS data on.)  
18:03:26 (Takeoff.)  
18:04:10 (AIS data off.)  
  
18:17:17 (Cockpit voice recorder on.)  
18:17:33 (Radar video recorder on.)  
18:17:39 (DLite instrumentation on.)  
18:17:43 METRO: Data on please.

AIS Record 3 - Penetration #1, FL310, 155°.

18:17:54 Bring data on, as per request.  
18:18:10 (AIS and DLite data on.)  
18:18:15 METRO: What are tops where you are?  
18:18:21 We're in tops now. Obscured by clouds and can't get a clear look.  
18:18:43 Cloud exit left side.  
18:18:55 Cloud exit. (Event.)  
18:19:08 (AIS and DLite data off.)  
  
18:19:42 Data systems are off between 2 large clouds.  
18:20:00 No turbulence or precipitation in the cloud we came through.

AIS Record 4 - Penetration #2.

18:20:31 Data on.  
18:20:45 Penetration #2, FL310, heading 190°.  
18:20:50 (AIS and DLite data on. Time code stable.)  
18:20:51 Very bright clouds, no turbulence, no precipitation.  
18:21:11 METRO: Your heading looks good on the Hatteras display.  
18:22:02 Descending through 29,000 ft. We have a block from FL260 to FL330.  
18:22:15 Nearby flashes.  
18:22:21 Occasional light turbulence, no precipitation.  
18:22:25 Now very light precipitation.  
18:22:28 Nearby flash ahead.  
18:22:49 Conditions unchanged.  
18:22:59 Now darker.  
18:23:00 Nearby flash.  
18:23:05 Camera on. (External movie camera on.)

18:23:13 2.5 miles away. All green.  
18:23:17 Very light chop.  
18:23:18 Light turbulence, very light rain.  
18:23:20 Nearby flash.  
18:23:35 Nearby flashes, light rain, light turbulence.  
18:23:48 Nearby flashes.  
18:23:57 Getting extremely bright now.  
18:23:59 Turbulence picking up.  
18:24:00 Cloud exit.  
18:24:02 (Event for cloud exit.)  
18:24:04 Camera off. (External movie camera off.)  
18:24:09 (AIS and DLite data off.)  
  
18:24:10 Data off.  
18:24:13 Saw more lightning that time.  
18:24:18 METRO: We saw some decent field mill near end of penetration, so  
want you to 90°-270° right back in at same altitude.  
18:24:30 OK. We'll cancel our descent.  
18:25:18 METRO: UHF suggest drop altitude 2,000 ft , down to about 27.

## AIS Record 5 - penetration #3.

18:25:39 Data systems on.  
18:25:44 2.5 n.mi. to the storm. All green.  
-5° tilt.  
28 - descending.  
18:25:52 Event for cloud entry.  
18:25:58 (Event for cloud entry.)  
18:25:59 Penetration #3, 340°, FL270.  
18:26:00 (AIS and DLite data on. Time code stable.)  
18:26:09 Nearby flash.  
18:26:12 Camera on. (External movie camera on.)  
18:26:13 Continuous light turbulence, light rain.  
18:26:22 Rain dies off to nil, occasional light turbulence.  
18:26:26 Breakout above.  
18:26:32 Just flew out of storm.  
18:26:37 Camera off. (External movie camera off.)  
18:27:01 (AIS and DLite data off.)  
  
18:27:22 Data systems are off.  
18:28:35 On a heading of due east we see lots of clouds visually, but  
nothing on radar.

## AIS Record 6 - Penetration #4, FL280, East.

18:28:40 (AIS and DLite data on.)  
18:29:05 Nearby flashes ahead.  
18:29:08 Occasional light rain, occasional light turbulence.  
18:29:15 Darkest clouds today.  
18:29:27 Nearby flash.  
18:29:52 816 now wings level. FL270, heading due south.  
18:29:58 Nothing ahead on the radar on this heading.  
18:30:07 (Event for cloud exit.)  
18:30:12 We just had cloud exit. We're totally out in the clear.



18:30:20 (AIS and DLite data off.)

18:31:48 We've had 4 penetrations so far.  
18:32:54 Temperature has dropped to 80°.

AIS Record 7 - Penetration #5.

18:33:00 Data systems on. Penetration #5, Heading 020°, FL280. (AIS and DLite data on.)  
18:33:24 Cloud entry - event. (Event.)  
18:33:29 Immediate light turbulence, very light rain.  
18:33:41 METRO: Good field mills.  
18:33:44 Clouds are getting darker through here.  
18:33:49 Nearby flash.  
18:33:50 Very close flash.  
18:33:51 No triggers.  
18:33:53 Camera on. (External movie camera on.)  
18:34:01 Light rain, very light turbulence.  
18:34:15 Nearby flash overhead. Other conditions unchanged.  
18:34:21 METRO: 90°-270° to same place.  
18:35:11 Nearby flash on right side.  
18:35:21 27.5 is altitude  
18:35:31 Camera off. (External movie camera off.)  
18:35:44 In left 270° in the clouds.  
18:36:28 Calm and dry.  
18:36:33 Keeping data on, as we are in solid clouds.  
18:37:48 METRO: UHF suggest 29,000. Jump it up a little bit, please.  
18:38:04 Cycle data momentarily.  
18:38:05 (AIS and DLite data off.)

18:38:21 Present heading is 200°. Climbing to FL290.

AIS Record 8 - Penetration #6, FL290, 200°.

18:38:25 Just cycled data to give you penetration #6.  
18:38:30 (AIS and DLite data on.)  
18:38:40 Clouds are brighter at this altitude, and it's smooth and dry.  
18:39:05 Occasional light turbulence, no precipitation.  
18:39:10 Now very light precipitation.  
18:39:29 METRO: We suggest you come left about 20°.  
18:39:39 With your call to come left we had a nearby flash.  
18:39:44 Partial breakout above and on right wing.  
18:39:51 We have storm 12 o'clock at 12 miles. Do you see that one?  
18:39:59 METRO: Doesn't show much.  
18:40:03 Best we've seen today. Green and and yellow.  
18:40:06 Clouds getting extremely bright.  
18:40:13 Cloud exit above.  
18:40:20 (Event for cloud exit.)  
18:40:35 (AIS and DLite data off.)

18:41:11 Bring data on since we are in cloud.

AIS Record 9 - Penetration #7.

18:41:17 Penetration 7, 220°, FL290.  
 18:41:30 (AIS and DLite data on.)  
 18:41:32 Calm and dry.  
 18:41:45 Very light precipitation and light turbulence.  
 18:42:00 Camera on. (External movie camera on.)  
 18:42:01 Moderate turbulence, moderate rain.  
 18:42:09 Rain stops.  
 18:42:10 Turbulence stops.  
 18:42:11 Cloud exit.  
 18:42:25 Camera off. (External movie camera off.)  
 18:42:26 (AIS and DLite data off.)

18:42:27 (Data off.)

AIS Record 10 - Penetration #8.

18:44:05 Data on, except camera.  
 18:44:08 Penetration #8, 070°, FL300.  
 18:44:20 (AIS and DLite data on. Time code stable.)  
 18:44:26 METRO: We are seeing field mill activity.  
 18:44:28 Occasional light turbulence, no precipitation.  
 18:45:02 Cloud exit.  
 18:45:04 Event.  
 18:45:05 (Event for cloud exit.)  
 18:45:24 Event for reentry.  
 18:45:47 (Event for reentry.)  
 18:45:52 Back in again.  
 18:45:53 Back out again.  
 18:45:57 (Event for cloud exit.)  
 18:46:07 Nothing on radar.  
 18:46:35 Nothing on radar. Only visual observations.  
 18:46:40 Event for cloud entry. (Event.)  
 18:46:45 Occasional light turbulence at this time, no rain.  
 18:47:00 Completely clear from wingtips up.  
 18:47:50 Light turbulence, no precipitation.  
 18:47:54 Now descended to 28,000 ft. Trying to get more in the storm.  
 18:48:00 Light turbulence. Light rain and finally it is getting dark.  
 18:48:13 (Event for cloud exit.)  
 18:48:14 Cloud exit. Event.  
 18:48:18 (AIS and DLite data off.)

18:48:19 Data off.  
 18:49:40 METRO: 330°/40 n.mi. from your present position to cell.  
 18:50:06 Do field mill and suggest that data should be on?  
 18:50:51 METRO: We'd like you to come to 200°.  
 18:51:28 METRO: Data on please. Active field mills.

AIS Record 11 - Penetration #9.

18:51:32 Data systems on.  
 18:51:50 (AIS and DLite data on. Time code stable.)  
 18:52:02 We are calling this penetration 8, FL280, heading about 210°.  
 (actually penetration 9).  
 18:52:11 Smooth and dry, moderately dark clouds.

18:52:41 Clouds very bright, occasional light turbulence.  
18:53:02 METRO: What does your radar show, 816?  
18:53:10 We see green cells, a small group of them about 15-20 miles ahead at minus 4° tilt.  
18:53:19 METRO: Go for them.  
18:53:24 Clouds extremely bright through here.  
18:53:30 Cloud exit above.  
18:54:08 5,800 lbs. fuel.  
18:54:32 Occasional light turbulence and the clouds are dark.  
18:55:04 Light rain has just begun.  
18:55:05 Nearby flashes.  
18:55:09 METRO: Good field mill.  
18:55:10 Camera on. (External movie camera on.)  
18:55:15 Light turbulence, light rain.  
18:55:33 Cloud exit.  
18:55:35 (Event for cloud exit.)  
18:55:49 Camera off. (External movie camera off.)  
18:55:50 (AIS and DLite data off.)  
  
18:55:51 Master data switch off.  
  
AIS Record 12 - Penetration #10.  
  
18:58:05 Data on.  
18:58:09 Penetration #9 (actually number 10), FL280, heading 060°.  
18:58:20 (AIS and DLite data on. Time code stable.)  
18:58:32 A little bit of green ahead about 5 miles on radar.  
18:58:42 (Event for cloud entry.)  
18:58:43 Cloud entry with an event.  
18:58:48 Now in the cloud.  
Light to moderate turbulence, light rain.  
18:58:57 Camera on. (External movie camera on.)  
18:59:10 Light turbulence, light rain.  
18:59:35 METRO: Suggest 20° turn to the right, based on Hatteras.  
18:59:56 Nothing on radar.  
19:00:11 Camera off. (External movie camera off.)  
19:00:30 No returns on radar on 070° out to 160 n.mi.  
19:00:34 Cloud exit to left.  
19:00:45 METRO: Come right to East.  
19:01:29 No returns on radar, calm and dry and extremely bright.  
19:01:50 METRO: Level 4 area near you. Must be well below you.  
19:02:15 Cloud exit on right side of aircraft.  
19:02:36 Cloud exit with event. (Event.)  
19:02:42 (AIS and DLite data off.)  
  
19:02:43 Data off.  
19:02:48 How much further this heading?  
19:02:50 METRO: No further. Make left turn, and we want to head you for a storm at Cape Henry on the way home.  
  
19:06:18 I don't see anything on radar. Tell me where storm is.  
19:06:23 METRO: 12 o'clock/60 miles.  
19:08:50 METRO: We have slow excursions on the field mills.  
19:08:55 Worth turning data on for?  
19:08:57 METRO: What's weapons bay temperature?

19:09:53 90°. I suggest hold off until we get to cell.  
19:09:08 METRO: I agree.  
19:09:14 It's getting warmer as we come down.  
19:10:05 -5° tilt.  
19:10:14 What do you see at 0° tilt?  
19:10:23 Zip.  
19:12:51 What I thought I saw, I don't see.  
19:13:10 Metro, we don't see too much ahead of us on this particular heading. Is the cell still there?  
19:13:15 METRO: Come right 20°.  
19:14:37 We are 25,000 ft , 020°. Nothing radar. We are in clouds, so can't pick it up visually.  
19:15:06 Looks like I just lost HSI.  
19:15:57 All at once HSI started turning to left.  
19:16:38 Going to do DLite Cal.  
19:16:42 Data on: DLite Call.

## AIS Record 13 - DLite Cals.

19:16:50 (AIS and DLite data on.)  
19:16:48 (Two sets of DLite LeCroy cals.)  
19:18:24 (AIS and DLite data off.)  
19:18:33 (DLite instrumentation off.)  
19:18:45 (DLite master power off.)  
19:18:56 (Cockpit voice recorder off.)  
19:19:07 (Radar video recorder off.)

## AIS Record 14 - Landing.

19:24:10 (AIS data on.)  
19:25:53 (Landing.)  
19:27:14 (AIS data off.)

## AIS Record 15 - Chocks.

19:29:40 (AIS data on.)  
19:30:22 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 030 F-106B

Date July 2, 1984

Crew Neely/Fisher

Engine Start 17 : 52:30

Take-off 18 : 03:26

Landing 19 : 25:53

Lightning Systems:

Dlite 0 Triggers  
40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$   
10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$   
10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$   
10ns LeCroy IV.1 TP100 2 TP101 3 TP102  
Digital Peak Counter 1  $\dot{I}=0$  2  $\dot{D}_F=0$

Non-Lightning Systems:

AIS No vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 0 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 0 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Swanquarter, NC

Pens 10

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 030

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ OK \_\_\_\_\_

LDAR \_\_\_\_\_ NU - Too far \_\_\_\_\_

UHF Radar \_\_\_\_\_ Real time only \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ NG - Out of range. \_\_\_\_\_

LaRC \_\_\_\_\_ NI \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NI \_\_\_\_\_

LLP PINOP (Dahlgren down)

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ OK \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

STORM HAZARDS '84 AIRCRAFT SQUAWK

Flight No. 84-030

Date: July 2, 1984

1. Primary Xponder.
2. Compass.

Debrief Notes for Flight 84-031, July 7, 1984

Storm Flight/Cape May to Norfolk, VA

Neely/Winbarger

GMT

AIS Record 1 - Video Check.

15:28:00 Engine start.

AIS Record 2 - Takeoff.

15:39:50 (AIS data on.)

15:41:04 (Liftoff.)

15:41:39 (AIS data off.)

15:59:10 SPANDAR: We just did a scan. Don't see anything much along level 3 in your area. One level 4 due west of your position about 10 miles.

15:59:31 This storm is going away as we get closer to it.

16:00:14 We see a storm but don't see it on radar. I don't know what this radar is doing but it sure isn't telling us what's out here.

AIS Record 3 - Pen #1.

16:00:50 Bring data on.

16:01:00 (Data on.)

16:01:58 Just entered cloud. 040°, heading 25-7 on (event-entry) altitude. Nothing showed on radar for this.

16:02:12 SPANDAR: We have found better storm tip of Cape May, due south of you about 35 miles. METRO: Would like you to come back thru that one.

16:02:42 Very bright cloud. Not much of anything in it.

16:02:51 SPANDAR: Storm is 220°, 15 n.miles, Sea Isle.

16:03:09 (Data off.)

16:04:17 SPANDAR: Bring data on.

AIS Record 4 - Pen #2 (Cloud).

16:04:21 Data is on.

16:04:30 (Data on.)

16:05:36 METRO: Echo's ahead.

16:06:03 (Data off.)

16:07:44 Data is on.

AIS Record 5 - Pen #3.

16:07:50 In first clouds.

16:07:56 Heading 200°, altitude 26,000.

16:08:00 (Data on.)



16:08:27 Out of that one.  
16:08:30 (Data off.)  
16:08:56 4° down on tilt.

## AIS Record 6 - Pen #4.

16:09:10 (Data on.)  
16:09:32 We're still 5 miles from contour but we are in clouds.  
Data is on.  
16:10:07 Camera on.  
16:10:20 Little precip now.  
16:10:25 Light turbulence.  
16:10:31 (All LeCroys triggered, Aft camera and cockpit video recorded strike.)  
16:10:31 Strike!  
16:10:48 (Event - storm exit.)  
16:10:52 (Data off.)  
16:10:54 We're out.  
16:10:57 Go back and do it again and do you think you ought to go up a little bit?  
16:11:04 If we do we won't be able to see the storms.  
16:11:37 Light turbulence and light precip at time of strike.  
16:12:05 We're at the tops of storms at altitude we're at now.

## AIS Record 7 - Pen #5.

16:13:00 (Data on.)  
16:13:11 (Event - storm entry.)  
16:13:14 We're back in heading 030°, altitude 27-5, Pen 5.  
16:13:22 METRO: Good field mills.  
16:13:27 Light precip.  
16:13:42 Almost no turbulence.  
16:14:33 (Data off, At cloud exit.)  
16:15:02 METRO: Level about 10 miles, 12 o'clock.

## AIS Record 8 - Pen #6.

16:16:00 (Data on.)  
16:16:11 (Event - storm entry.)  
16:16:14 We're back in heading 020°, altitude 26,000.  
16:16:28 Metro; Real good field mills.  
16:16:30 Just a little light precip.  
16:16:33 Short one. We popped out.  
16:16:39 (Event - cell exit.)  
16:16:40 METRO: Go back in it.  
16:17:00 (Event - cell entry.)  
16:17:06 We're in another cell. What do field mills look like on it.  
16:17:09 METRO: They are moving around. Sorta low frequency stuff.  
16:17:22 We're turning south.

16:18:19 (Data off.)  
16:19:45 We are steady 195° now to go thru a small cell then  
we'll come right to 220°.

## AIS Record 9 - Pen #7.

16:19:59 (Event - storm entry.)  
16:20:00 (Data on.)  
16:20:09 6,000 lbs fuel.  
16:21:33 Weapons bay 84°.  
16:22:10 METRO: Echo's ahead.  
16:22:22 METRO: Not much field mill activity.  
16:22:27 Just in smooth cloud so far.  
16:22:52 Getting a little turbulence now.  
16:23:04 Broke out.  
16:23:09 (Data off.)(Event - storm exit.)  
16:23:25 METRO: Next storm is 250°, heading at 15' to 25', there  
is two of them in that region.  
16:24:00 METRO: The biggest one is 230° at 25.  
(Discussion on which storm to go to.)

## AIS Record 10 - Pen 8.

16:28:40 (Data on.)  
16:28:45 (Event - storm entry.)  
16:29:49 We're in the storm, still turning to the left.  
16:28:56 Pretty good turbulence in here.  
16:28:56.7 (All LeCroys triggered, Aft camera and cockpit video  
recorded strike.)  
16:28:57 Strike!  
16:29:00 That was from the left.  
16:29:07 That was moderate turbulence, no precip at time of  
strike.  
16:30:06 Popping in and out along thru here.  
16:30:40 Light turbulence.  
16:30:57 Little light precip.  
16:31:03 (Event - storm exit.)  
16:31:04 We're out.  
16:31:06 (Data off.)  
16:31:22 METRO: We want you to go to a cell 15 miles due south  
of Salisbury. Do you see it?  
16:31:41 Yeah. We see it.  
16:31:53 METRO: SPANDAR request when you make these penetrations  
you keep the heading constant so I'm going to suggest  
about 100°.  
16:34:17 METRO: Advise what you see on radar.  
16:34:21 One tiny little green dot at 15 miles, 160°.  
16:35:22 That dosen't go much above our altitude.  
16:35:29 METRO: Why don't you go down to 1,000 ft?  
16:35:32 OK.

16:36:22 METRO: Make left turn. 105°.  
16:37:19 METRO: LLP just showed a strike in that storm.  
16:37:38 METRO: We show you at storm contour right now.  
16:37:41 We're about 4 miles west of storm. We can see all way  
to the ground. We'll have to go on and penetrate re-  
ciprocal.

## AIS Record 11 - Pen #9.

16:40:00 (Data on.) Steady on 285°.  
16:40:03 (Event - storm entry.)  
16:40:09 Camera on.  
16:40:49 Nothing showing on radar now just a few bumps, we're  
in and out of the clouds.  
16:41:29 (Data off.)

## AIS Record 12 - Pen #10. (Repenetrate same storm about 090°.)

16:42:50 (Data on.) (Approx. 90° heading.)  
16:43:22 METRO: We suggest you come towards Cape Henry storm.  
We are getting a few echos around us. Doesn't look like  
anything serious, but we'd like you close in.  
16:43:36 (Data off.)  
16:43:54 METRO: We're getting LLP on Cape Henry storm?  
16:44:09 Weapons bay is 92°. Want me to turn instrument  
power off on way down there?  
16:44:18 METRO: Affirmative.  
16:46:22 METRO: The radar is showing a storm right in middle  
of entrance to Hampton Roads and another that may be  
over Norfolk, at 37,000, level 4.  
16:50:40 Weapons bay is 90° now.  
16:55:27 This is best looking stuff we've seen today. 2° down  
on tilt.  
16:55:37 Guess I better get stuff back on.

## AIS Record 13 - Pen 11.

16:55:59 (Event - storm entry.)  
16:56:03 We're back in storm. Heading 220°, altitude 27,000 ft,  
Pen 11.  
16:56:10 Camera on. (Data on.)  
16:56:11 Got precip.  
16:56:42 (Event - cell exit.)  
16:56:47 Just broke out in clear.  
16:57:00 We are coming right to a bigger storm looks like a  
heading of 250-270°.  
16:57:17 (Event - 2nd cell entry.)  
16:59:17 We didn't see anything on radar before penetrating.  
We just hit the blackest part.  
16:59:36 Little turbulence. No percip.

16:59:44 METRO: Nearby.  
17:00:01 Very Close.  
17:00:02 We're out.  
17:00:06 (Data off.)  
17:00:07 METRO: Go back thru that one and wind up 175°  
and 20 from Cape Charles VOR.  
17:00:34 What do you think of changing altitude or do you want  
us to stay up here?  
17:01:38 METRO: We suggest you RTB at this time.

## AIS Record 14 - Pen 12.

17:02:25 We're back in.  
17:02:30 (Data on.)  
17:02:32 Camera on.  
17:02:38 Still little precip.  
17:02:46 Light turbulence and dry.  
17:04:15 Light turbulence and dry.  
17:04:32 We are popping in and out.  
17:04:47 (Event - storm exit.)  
17:04:53 (Data off.)

## AIS Record 15 - Landing.

17:16:00 (AIS data on.)  
17:18:06 (Touchdown.)  
17:19:04 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-031 F-106B

Date July 7, 1984

Crew Neely/Winebarger

Engine Start 15:28:00

Take-off 15:41:04

Landing 17:18:06

Lightning Systems:

Dlite 2 Triggers

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP100 2 TP101 3 TP102

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

Non-Lightning Systems:

AIS No vanes. NRZ-L used.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 2 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 2 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Atlantic City, NJ

Pens 12

Strikes 2

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 031

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR OKUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NIELF Antenna NILLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-032, July 7, 1984

Storm Flight/Oceana, VA

Neely/Winebarger

GMT

18:35:10 Engine start.

AIS Record 1 - Takeoff.

18:44:30 (AIS data on.)

18:45:08 (Liftoff.)

18:45:36 (AIS data off.)

Starting out with real hot missile bay this time.

METRO: WILCO.

Got a good picture.

METRO: We would like to start you out at Norfolk  
150°, 25 nautical miles.

That is very southern tip of Dam Neck.

METRO: UHF says preferred altitude 32,000.

That what you want me to go?

METRO: Affirm.

Weapons bay 93°.

2° down on tilt.

Missile bay temp 90°.

AIS Record 2 - Pen #1.

18:58:10 (Data on.)

18:58:12 Data is on. Contour 5 miles ahead but we are in the  
clouds.

18:58:26 METRO: We see field mills.

18:58:54 Precip.

18:58:58 Some turbulence.

18:59:00 Distant flash.

28:59:04 (Aft camera and cockpit video recorded the strike.)

18:59:04 Strike!

18:59:08 A good strike no triggers.

18:59:18 Cameras were on.

18:59:22 Lots of flashes.

18:59:26.7 (All LeCroys triggered, Aft camera and cockpit video  
camera recorded the striks.)

18:50:27 Another strike!

18:59:35 Just moderate turbulence and moderate precip for both  
of them.

18:50:42 That was the largest strike I've ever.

19:00:01 METRO: 180° and come back.

19:00:37 Do you want to call data on and off for me to conserve  
the 30 minutes of tape I have?

19:00:44 METRO: We'll do that.  
19:00:47 Leave it on now.  
19:00:57 Temperature 89°.  
19:01:07 Did that sorta remind you of that?  
19:01:08 Yeah.  
19:01:11 Was that louder than normal?  
19:01:12 Loudest one I've heard.  
19:01:14 I've never seen anything like that in my life.  
19:01:16 METRO: Data off.

## AIS Record 3 - Pen #2.

19:04:16 METRO: Data on.  
19:04:30 (Data on.)  
19:04:39 We're heading 335°, altitude 32,000, penetration 2.  
19:04:55 3° down. 32,000 ft.  
19:05:07 2½ miles to storm.  
19:05:11 Getting a little turbulence now.  
19:05:25 Some precip.  
19:05:30 Distant flashes.  
19:05:36 METRO: Nearby.  
19:05:46.9 (All LeCroys triggered, Aft camera and cockpit video recorded the strike.  
Strike on video.  
19:05:47 Lot of flashes. We had triggers.  
19:05:51 Didn't see anything. Strike.  
19:09:56 There's another one.  
19:07:26 (Data off.)  
19:07:27 Data off.  
19:07:52 METRO: What does one at 12 o'clock look like?  
19:08:05 Nothing on radar but it's just about our altitude.

## AIS Record 4 - Pen #3.

19:09:54 METRO: Data on.  
19:10:10 (Data on.)  
19:10:21 Good looking storm 15 to 20 miles.  
19:10:30 Weapons bay temp 85°.  
19:11:14 METRO: Nearby.  
19:11:20 Brought camera on.  
19:11:38 METRO: Nearby.  
19:11:45 Precip, no turbulence.  
19:12:02 Continuous light precip.  
19:12:11 METRO: Nearby, looking good.  
19:12:15 Precip picking up.  
19:12:16 Turbulence picking up.  
19:12:19 Flashes.  
19:12:39 Distant flashes.  
19:14:45 METRO: Nearby.  
19:14:43 I'm letting them tell me when to turn the data on and off by the field mills.



19:15:37        Getting some turbulence.  
19:15:42        METRO: You're just about to the good part of the cell.  
19:15:45        Lots of distant flashes.  
19:15:50        Precipitation. Flash.  
19:16:25        Pretty good bounce.  
19:16:44        I think we're out of that. We've got another 15 miles.  
19:16:49        METRO: Do 180°, you are going to get out of SPANDAR Coverage.  
                 Make 180° come back through the line.  
19:17:00        Want data left on?  
19:17:04        METRO: Yeah, I think you better leave it on.  
19:17:09        We've used over half on tape - 45 minutes gone.  
19:17:16        METRO: Cut it off.  
19:17:16        (Data off.)  
19:17:25        Strike!  
19:17:26        Oh S...!  
19:17:27        Oh no.  
19:17:29        No more than turned it off. We took a strike.  
19:17:44        Out in smooth calm cloud, no precipitation, no turbulence, when  
                 we took the strike and we are breaking out.  
19:17:57        METRO: We saw your strike.  
19:18:03        Everything was off for that.  
19:18:54        METRO: Data on.  
19:18:56        No - no.  
19:18:58        We are out in the clear. We just went through a puffy.  
19:19:02        METRO: OK.  
19:20:04        We're back in the soup. Say when data on.

## AIS Record 5 - Penetration 4.

19:20:30        METRO: Data on.  
19:20:39        We're headed 044°, altitude 31-8, penetration 4.  
19:20:50        (Data on.)  
19:21:02        Turn camera on.  
19:21:26        Some pretty good turbulence, light precipitation and distant  
                 flashes.  
19:22:30        METRO: What does it look like on your radar straight ahead?  
19:22:34        Green dot at seven miles.  
19:22:39        METRO: A big red splotch on my radar.  
19:23:10        Precipitation.  
19:23:15        Few little bumps.  
19:23:22        METRO: UHF advises best altitude is down around 27 at this  
                 point.  
19:23:58        METRO: Nearby.  
19:24:00        Saw a real distant flash at that time.  
19:24:52        Kavouris has lost its memory.  
19:24:57        We have no picture now.  
19:26:16        (Data off.)  
19:26:18        METRO: Data off.  
19:29:33        METRO: Can you drop down another 2,000?

## AIS Record 6 - Pen #5.

19:29:40 (Data on.)  
19:29:44 We're in another storm. Heading 100°, altitude 27,000.  
19:29:50 METRO: Good field mills.  
19:29:56 METRO: Nearby.  
19:30:34 (Data off.)

## AIS Record 7 - Penetration 6.

19:33:05 METRO: Data on.  
19:33:20 (Data on.)  
19:33:44 METRO: Can you go up 4,000 ft, with Washinton?  
19:34:29 Want me to go to 29-30,000 ft?  
19:34:34 METRO: Right.  
19:35:26 METRO: What does your radar look like, Roger?  
19:35:29 The storm is just a green dot at 12 miles now.  
19:35:55 METRO: Data off, if you agree. (Data off).  
19:35:59 I have nothing to go by but clouds.

## AIS Record 8 - Pen 7.

19:36:28 METRO: Bring it back on.  
19:36:40 (Data on.)  
19:37:24 Getting precip and a little bit of bouncing.  
19:37:44 Camera on.  
19:38:04 56 minutes of DLite used.  
19:38:59 METRO: Nearby.  
19:39:15 Little bit of turbulence now.  
19:39:27 Some precip.  
19:39:39 Distant flashes.  
19:40:00 Some heavier precip now and little more turbulence.  
19:40:04 Distant flashes.  
19:40:26 METRO: Go down to 27. We are not doing any good.  
19:40:29 Only got a minute of tape left.  
19:40:33.9 (All LeCroys triggered, Aft camera and cockpit video recorded the strike.)  
19:40:34 Strike!  
19:40:42 That was moderate turbulence and moderate precip at that time.  
19:40:54 Heavy turbulence there.  
19:41:47 METRO: Data off.  
19:41:49 (Data off.)  
19:41:54 METRO: How much tape left?  
19:41:58 It shows 59.8. We got another green cell coming up. 7 miles.

## AIS Record 9 - Pen #8.

19:42:09 METRO: Data on.  
19:42:12 Not yet. Wait till we are closer. We're in the clear.

19:42:20 (Data on.)  
19:42:28 He called it on. I went ahead and did it. It's past  
60 but still going.  
19:42:40 Aft camera out of film.  
19:43:24 (Data off.)  
19:43:58 Tape was on 61.2 when we exited that.  
19:44:08 Got a temperature of 93°.  
19:44:25 Metro, what do you want us to do?  
19:44:44 METRO: Come home you can't have more than a half minute  
of tape.

AIS Record 10 - Pen #9.

19:44:51 METRO: Data on - you've got field mills.  
19:45:00 (Data on.)  
19:45:15 METRO: Data off.  
19:45:16 (Data off.)

AIS Record 11 - Landing.

20:01:40 (AIS data on.)  
20:02:37 (Touchdown.)  
20:03:15 (AIS data off.)

AIS Record 12 - Chocks.

20:06:20 (AIS data on.)  
20:06:50 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 032 F-106B

Date July 7, 1984

Crew Neely/Winebarger

Engine Start 18 : 35 : 10

Take-off 18 : 45 : 08

Landing 20 : 02 : 37

## Lightning Systems:

Dlite 3 Triggers

40ns LeCroy I.1  $\overset{\cdot}{D}_F$  2  $\overset{\cdot}{I}_N$  3  $\overset{\cdot}{I}_T$

10ns LeCroy II.1  $\overset{\cdot}{D}_T$  2  $\overset{\cdot}{I}$  3  $\overset{\cdot}{B}_L$

10ns LeCroy III.1  $\overset{\cdot}{D}_{W,R}$  2  $\overset{\cdot}{D}_{W,L}$  3  $\overset{\cdot}{D}_F$

10ns LeCroy IV.1 TP100 2 TP101 3 TP102

Digital Peak Counter 1  $\overset{\cdot}{I}=X$  2  $\overset{\cdot}{D}_F=X$

## Non-Lightning Systems:

AIS No vanes. NRZ-L used.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video NU

Voice NU

Kavouris Radar

Receiver OK

Aft movie camera 4 Strikes.

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 4 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Oceana, VA

Pens 9

Strikes 5

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 032

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ OK \_\_\_\_\_

LDAR \_\_\_\_\_ OK \_\_\_\_\_

UHF Radar \_\_\_\_\_ OK \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ OK \_\_\_\_\_

LaRC \_\_\_\_\_ NT \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NT \_\_\_\_\_

LLP \_\_\_\_\_ OK \_\_\_\_\_

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ OK \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

Debrief Notes for Flight 84-033, July 10, 1984.

Storm Flight/Martinsville, VA.

Neely/Rondeau

GMT

20:00:00 (Engine start)

AIS record 1 - Preflight.

19:49:40 (AIS on.)

19:49:50 (AIS off.)

AIS record 2 - Takeoff.

20:59:00 (AIS on)

20:59:30 (Takeoff.)

21:00:05 (AIS off.)

AIS record 3 - Penetration 1-5.

21:23:20 (AIS and DLite data on. Only DLite crate #2 connected.)

21:23:53 METRO: Lightning ahead.  
(Beginning of Penetration 1.)

21:24:01 We're in the cloud now.

21:24:02 Slight turbulence.

21:24:33 Nearby flashes.

21:24:45 More nearby flashes.

21:24:54.9 (DLite crate #2 triggers. Cockpit video camera records a strike.)

21:24:55 Precipitation.

21:24:56 Strike!

21:24:58 Got trigger.

21:25:03 Strike. (Cockpit video camera records a strike.)

21:25:04 Another strike.

21:25:09 Heavy rain.

21:25:12 Heavy turbulence.

21:25:13 Another strike! (Cockpit video camera records a strike.)

21:25:31 Nearby flashes.

21:25:38 More nearby flashes.

21:25:40 Moderate turbulence.

21:25:43 2° down on tilt.

21:25:53.9 (DLite crate #2 triggers)

21:25:58 METRO: Strike with a trigger.

21:26:00 Roger.

21:26:11 Strike! (Cockpit camera records a strike.)

21:26:12 Another strike.

21:26:13 METRO: Strike.

21:26:37 We got only 2 of those on data. They didn't have time to rearm.  
(End of Penetration 1.)

21:26:55 Leaving data on.

21:27:12 METRO: 90°-270°?

21:27:17 More or less.  
21:27:25 Comment for the record. Radar is just now picking it up.  
21:28:50 5° down on tilt.  
21:29:01 METRO: We counted 5 hits before we lost communication. Did you get anymore?  
21:29:08 No. We count 5.  
21:29:17 Heading now 160°.  
21:30:10 Getting precipitation.  
(Penetration 2)  
21:30:13 We're in the cloud now.  
21:30:16.1 (DLite crate #2 triggers)  
21:30:20 METRO: Calling this penetration?  
21:30:24 Yes. This is second penetration. (Cockpit video and external cameras record a strike.)  
21:30:26 We just got a strike and got a trigger.  
21:30:32 Heavy turbulence.  
21:30:37 (DLite crate #2 triggers.)  
21:30:39 Another strike and trigger. (Cockpit and external cameras record a strike.)  
21:31:30 METRO: Take heading of 070°.  
(End of Penetration 2)  
21:31:37 We're out of that one, right?  
Yep.  
21:32:29 (DLite mars tape recorders failed)  
21:32:30 METRO: Take heading of 30° and make penetration along that line. I think you'll take a strike.  
21:32:48 I don't trust radar. I'm going to keep 070°.  
21:33:06 METRO: What was radar showing while you were getting those 5 hits?  
21:33:16 Level 3 and 4, mostly 3. Mostly green.  
21:33:25 I see the first red I've seen in quite a while just in front of me. We'll be going around it, I think.  
21:33:41 METRO: Directly ahead of you we show only level 1, blue.  
21:33:44 I don't agree with that.  
(Penetration 3)  
21:33:48 Penetration #3.  
21:33:55 Nearby flashes, slight precipitation.  
21:34:01 Moderate to heavy turbulence.  
21:34:05 Another nearby flash.  
21:34:12 (DLite crate #2 triggers.)  
21:34:17 Heavy turbulence, nearby flashes. That's not heavy, light to moderate.  
21:34:22 METRO: You got a trigger.  
21:34:24 Roger on that.  
21:34:27 METRO: Weapons Bay temperature?  
21:34:30 65°.  
21:34:38 Did we just get a strike?  
21:34:41 Got a trigger.  
(End of Penetration 3)  
21:35:10 METRO: Have you gotten in any heavy rain yet?  
21:35:14 Yeah, a little bit. We are working our way a little bit deeper into the storm each time.  
(Penetration 4)  
21:37:02 Nearby flashes on the 4th penetration.

21:38:03 Strike! (DLite crate #2 triggers) (Cockpit and external cameras record a strike.)  
21:38:05 We got triggers.  
21:38:10 Radar blinked.  
21:38:20 Strike!  
21:38:21 (DLite crate #2 triggers) (Cockpit and external cameras record a strike.)  
21:38:28 Small strike, triggers.  
21:39:26 Is this moderate?  
Yeah.  
21:39:28 Moderate turbulence.  
21:39:30 Nearby flashes.  
21:39:32 Heavy rain.  
21:39:34 Strike! (Cockpit and external cameras record a strike.)  
21:39:37 No trigger.  
21:40:19 (External camera records a strike.)  
21:40:23 Nearby flashes.  
21:40:25 Heavy rain.  
(End of Penetration 4)  
21:40:59 Are we out of it?  
Yeah.  
21:41:03 End of 4th penetration.  
21:41:44 Weapons bay temperature 65°.  
21:43:07 Camera off. (External camera off.)  
21:43:23 (DLite recorders back up.)  
21:43:44 Camera on. (External camera on.)  
(Penetration 5)  
21:43:49 METRO: Are you in penetration 5 now?  
Roger.  
21:44:37.2 (DLite crate #2 triggers)  
21:44:44 METRO: Did you get a strike, got a trigger?  
21:44:47 I got a trigger. I didn't see a strike.  
21:44:54 Just had a nearby flash.  
21:45:22 Nearby flashes.  
21:45:53 Nearby flashes.  
21:46:06 Moderate to heavy turbulence.  
21:46:44 Hail (Tape noise.)  
21:46:53 Extremely heavy turbulence.  
21:46:56 Rain.  
21:46:58 Strike! No trigger (Cockpit camera records a strike.)  
21:47:47 Aft camera is out of film.  
21:48:45 (AIS and DLite data off.)  
(End of Penetration)  
  
21:48:55 My guess is radar is still not right. That should have been level 5. That last one sure should have.  
21:49:24 METRO: What does DLite tape counter show?  
21:49:28 15.3..  
21:49:54 Metro, want CALs now?  
21:49:57 Affirmative.  
  
AIS record 4 - DLite cals.  
  
21:50:20 (AIS and DLite data on.)



21:52:10 (2 LeCroy calcs.)  
(AIS and DLite data off.)

AIS record 5 - Landing.

22:17:00 (AIS data on.)  
22:18:17 (Landing)  
22:20:10 (AIS data off.)

AIS record 6 - Chocks.

22:21:40 (AIS data on.)  
22:23:08 (AIS data off.)

AIS record 7 - Chocks.

22:24:00 (AIS data on.)  
22:27:40 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-033 F-106B

Date July 10, 1984

Crew Neely/Rondeau

Engine Start 20:00:00

Take-off 20:59:30

Landing 22:18:17

Lightning Systems:

Dlite 4 Triggers

LeCroy I.1 INOP 2 INOP 3 INOP

10ns LeCroy II.1 <sup>D</sup>T 2 <sup>I</sup> 3 <sup>B</sup>L

LeCroy III.1 INOP 2 INOP 3 INOP

LeCroy IV.1 INOP 2 INOP 3 INOP

Digital Peak Counter 1 <sup>I</sup> INOP 2 <sup>D</sup>F INOP

Non-Lightning Systems:

AIS No Vanes.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice PINOP\*\*

Kavouris Radar

Receiver OK

\*\* Noise late in tape

Aft movie camera 6 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 10 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Martinsville, VA

Pens 5

Strikes 14

Nearbys 1

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 033

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR Real time onlyVideotape NU - Too farDigital dBZ Tape NU - Too farLDAR NG - Too farUHF Radar NG - Too farC-Band Tracking Intermittent. Too far.Goddard Antennas OKGSFC NU - Too farWFF NG - Too farLaRC NTELF Antenna NTLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Flight 84-034, July 11, 1984  
Instrumentation Check Flight/ Local  
Brown/Winebarger

No notes taken.

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-034 F-106B

Date July 11, 1984

Crew Brown/Winebarger

Engine Start 17:19:19

Take-off 17:31:28

Landing 18:47:15

## Lightning Systems:

Dlite 0 Strikes. \*

40ns LeCroy I.1  $\dot{D}_F$  2  $I_N$  3  $I_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{i}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

5ns LeCroy IV.1 TP100 2 TP101 3 TP102

Digital Peak Counter 1 NI 2 NI

\* Cooling intake open

Aft movie camera 0 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video NU

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

## Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

Region Local

Pens 0

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84-034

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OK - CalsVideotape NUSatellite Pictures OKWallopsSPANDAR NUVideotape Digital dBZ Tape LDAR NUUHF Radar NUC-Band Tracking NUGoddard Antennas NUGSFC NUWFF NULaRC NIELF Antenna NILLP NUWFF Plots LaRC Plots WFF Tape

Debrief Notes for Flight 84-035, July 16, 1984

Storm Flight/Hopewell, VA

Brown/Fisher

GMT

18:09:29 (Engine start.)  
18:11:00 (DLite master power on.)

AIS Record 2 - Takeoff.

18:24:20 (AIS data on.)  
18:24:40 (Takeoff.)  
18:25:27 (AIS data off.)

18:29:18 (Cockpit voice recorder on.)  
18:29:30 (Radar video recorder on.)  
18:30:14 (DLite instrumentation on.)  
18:30:00 Radar, video and voice are on.  
18:30:26 SPANDAR: We show level 5. Your altitude, bearing 315° your position, 10 miles.  
18:30:50 Going to bring data on.  
18:31:01 METRO: We just showed an LLP hit right on your position.

AIS Record 3 - Penetration #1, 12,000 ft-16,000 ft.

18:31:10 (AIS and DLite data on.)  
18:31:22 Calling this penetration #1 as we enter the clouds and come on up.  
18:31:25 We had moderate rain at cloud entry.  
18:31:28 Very light rain at this time.  
18:31:34 Some nearbys.  
18:31:50 Moderate rain, Nearby flashes, light turbulence.  
18:31:53 Passing 15,000 feet.  
18:32:03 METRO: Weapons bay temperature?  
18:32:05 Cloud exit.  
18:32:10 Weapons bay temperature is 83°.  
18:32:29 Getting very wispy.  
18:32:39 (Event for cloud exit.)  
18:32:45 (AIS and DLite data off.)

18:34:03 Bring Stormscope on. Not supposed to work today, though.

AIS Record 4 - Penetration #2, 17,000 ft , South.

18:35:50 Data systems on for penetration #2. We are heading almost due South. (AIS and DLite data on.)  
18:35:59 We are getting some Stormscope points.  
18:36:02 (Points) Wingtip-to-Wingtip.  
18:36:05 We're leveling at 180 (18,000 ft).  
18:36:08 Nearby flash.

18:36:10 Light turbulence.  
18:36:11 Light to moderate rain.  
18:36:14 METRO: And field mills.  
18:36:15 Nearby flash.  
18:36:19 Nearby flash overhead.  
18:36:24 Call it moderate rain now.  
18:36:30 Flashes, good burst of rain - call it moderate.  
18:36:35 Nearby flash.  
18:36:58 Camera on. (External movie camera on.)  
18:37:16 Camera off. (External movie camera off.)  
18:37:22 Cloud exit - event. (Event.)  
18:37:27 (AIS and DLite data off.)  
  
18:37:28 Data off.  
18:37:44 METRO: SPANDAR advises cell just about over Harcum now and it's  
45,000 ft/level 5.  
18:37:57 (Cell beyond clearance limit for now.)

## AIS Record 5 - Penetration #3, 18,000 ft , 030°.

18:38:14 Data systems are on.  
18:38:22 METRO: (Storm 30°/20 miles from airplane - change clearance.)  
18:38:30 (AIS and DLite data on. Time code stable.)  
18:38:50 Little hit of red in there.  
18:38:52 Looking level now.  
18:39:01 Data systems on for penetration #3, 18,000 ft., heading 040°.  
18:39:22 METRO: What does your radar show?  
18:39:25 We see a line of cells. A little bit of red, mostly yellow. The  
nearest edge of return is about 8 miles and it extends on out.  
The largest red area is about 15 miles, bearing 035°-to 040°.  
  
18:40:01 Some light turbulence.  
18:40:07 Camera on. (External movie camera on.)  
18:40:09 Light rain, light turbulence.  
18:40:22 Light turbulence and very light rain.  
18:40:32 SPANDAR: 040° your position, level 5, 10 miles.  
18:40:40 Nearby flashes-left side.  
18:40:57 Nearby flash.  
18:41:02 Light turbulence, light to moderate rain.  
18:41:08 Very close flashes.  
18:41:12 Nearby flash overhead.  
18:41:21 Heading 020°.  
18:41:23 Nearby flashes.  
18:41:32 Continuous light turbulence and light rain.  
18:41:34 Nearby flashes.  
18:41:41 Nearby flashes.  
18:41:55 Very close flashes ahead.  
18:41:59 Still light turbulence.  
18:41:59.5 (DLite LeCroy triggers 1,2 and 4. Cockpit video and external  
movie camera record a strike.)  
  
18:42:00 Direct strike to airplane. Triggers.  
18:42:06 Now in moderate rain, light turbulence.  
18:42:09 Bright flash ahead.  
18:42:20 That was quiet, but bright.  
18:42:32 Light turbulence, very light rain.



18:42:34 Getting brighter.  
18:42:37 Another cell of green, yellow and red about 5 miles ahead on this heading.  
18:42:53 All cameras running.  
18:42:59 Light turbulence, light to moderate rain.  
18:43:01 Now continuous moderate rain.  
18:43:09 (In right turn.)  
18:43:28 Nearby flashes.  
18:43:33 Camera off. (External movie camera off.)  
18:43:46 Keeping data on.  
18:43:47 Lots of strobing going on. (On radar.)  
18:44:02 Strobing may be due to G loads, but radar performing best it has this year in level flight.  
18:44:40 Cycle data - off - on.  
18:44:41 (AIS and DLite data off.)

AIS Record 6 - Penetration #4, 18,000 ft.

18:44:52 Camera on. (External movie camera on.)  
18:44:53 METRO: That strike showed up principally on E<sub>x</sub> field mill. The others - very little.  
18:45:00 (AIS and DLite data on. Time code stable.)  
18:45:09 SPANDAR: 150° your position, 15 miles, level 5. 170° your position, 20 miles, level 6.  
18:45:20 That's off our left wing. We are in moderate rain, light turbulence. This is penetration #4.  
18:45:32 In left turn to align with line of storms.  
18:45:38 Although we are getting good reflection off the data (good radar return), even in small bank angles we are getting extensive strobing on the screen. Haven't seen that before.  
18:46:13 Camera off. (External movie camera off.)  
18:46:19 Tilt is zero.  
18:46:22 Wonder what that funny strobe is?  
18:46:23 I don't know. Nearby flash.  
18:46:27 Camera on. (External movie camera on.)  
18:46:30 Nearby flash.  
18:46:31 We are in very light turbulence, very light rain.  
18:46:36 (Right turn - fly westside of red and yellow returns.)  
18:46:44 Continuous light turbulence, light to moderate rain.  
18:46:47 Nearby flash.  
18:46:51 Nearby flash.  
18:47:00 Very close flash.  
18:47:01 Strike (Pilot called - no triggers.)  
18:47:13 Nearby flash. In moderate, turbulence and light to moderate rain.  
18:47:18 Nearby flash.  
18:47:23 Another nearby flash. Other conditions unchanged.  
18:47:33 Nearby flashes.  
18:47:48 Nearby flashes and crackles in headset.  
18:48:02 Nearby flashes.  
18:48:03 Down to light rain and light turbulence.  
18:48:13 Lots brighter now.  
18:48:21 Moderate turbulence.  
18:48:23 Light rain.

18:48:28 Light turbulence, moderate rain.  
18:48:41 Camera off. (External movie camera off.)  
18:50:00 Breakout, left wingtip.  
18:50:13 (AIS and DLite data off.)  
  
18:50:18 Zero tilt.  
  
AIS Record 7 - Penetration #5, 18,000 ft , 060°.  
  
18:50:44 Data on.  
18:50:46 SPANDAR: We have 2 area level 5's, 030° and 055°, 12 miles.  
18:50:58 This radar correlates pretty well with what they are calling.  
18:51:00 I don't know. We got more red than we probably should have.  
(AIS and DLite data on. Time code stable.)  
18:51:04 You've got 40 dB<sub>Z</sub>, too. (Red on radar set for 40 dB<sub>Z</sub> on this flight.)  
18:51:07 Penetration #5, 18,000 ft , 060°. In light to moderate turbulence. Now moderate turbulence and light rain.  
18:51:15 Nearby flash.  
18:51:25 Camera on. (External movie camera on.)  
18:51:30 Very close flashes, crackle in headset, no triggers.  
18:51:34 Now in moderate rain, light to moderate turbulence.  
18:51:39 Nearby flash overhead.  
18:51:46 Updraft - 1000 ft./min.  
18:51:51 Rain and turbulence down to light.  
18:51:54 Rain immediately back to moderate, light to moderate turbulence.  
18:51:58 Nearby flash.  
18:52:05 Heavy rain.  
18:52:11 Rain immediately drops off to light.  
18:52:14 Nearby flash.  
18:52:29 Camera off. (External movie camera off.)  
18:52:33 Left turn to new cell.  
18:52:39 One burst of heavy rain there.  
18:53:09 Wings level. Heading 355°.  
18:53:21 Camera on. (External movie camera on.)  
18:53:25 Moderate rain, coming in bursts.  
18:53:27 Almost heavy rain now, light to moderate turbulence.  
18:53:32 Rain off to light, turbulence light.  
18:53:41 Nearby flash, and another one.  
18:54:13 This will be a turning penetration.  
18:54:16 METRO: Say weapons bay temperature.  
18:54:19 All way down on bottom - off scale.  
18:54:24 In light to moderate rain, light to moderate turbulence.  
18:54:31 1500 ft/min climb.  
18:54:46 Continuous moderate turbulence and light to moderate rain.  
18:54:57 33 miles out.  
18:55:05 Light rain, light to moderate turbulence.  
18:55:14 Kinda of a big "C" - shaped penetration.  
18:55:27 SPANDAR: Level 5, your position - 10 miles.  
18:55:37.4 (DLite LeCroy triggers 1,2, and 4. Cockpit video and external movie camera record a strike.)  
  
18:55:39 Strike.  
18:55:43 Triggers.  
18:55:49 In light rain and light to moderate turbulence (at the time).

18:55:52 That was a real quiet one, too.  
18:55:54 I could feel it or hear it.  
18:55:57 There's another one!  
18:55:57.5 (DLite LeCroy triggers 1,2, and 4. Cockpit video and external movie camera record a strike.)  
18:55:59 Heard that one.  
18:56:00 Triggers again.  
18:56:08 The clouds are almost green through here.  
18:56:09 Different color.  
18:56:10 Very close flashes.  
18:56:12 Light to moderate turbulence, light rain all through here.  
18:56:16 Gonna get heavier, I think.  
18:56:18 Nearby flashes.  
18:56:23 Going to moderate rain, light to moderate turbulence.  
18:56:33 Good updraft - 1000 ft /min  
18:56:38 Nearby flash, and another.  
18:56:48 Nearby flash, and we go to moderate rain, light to moderate turbulence.  
18:57:01 Burst of heavy rain, and another burst.  
18:57:06 Getting very bright. Rain is off to light. Turbulence falls off to light.  
18:57:18 Camera off. (External movie camera off.)  
18:57:26 (AIS and DLite data off.)  
18:57:27 Turn the data off for a minute.  
AIS Record 3 - Penetration #6, 18,000 ft.  
18:57:40 (AIS and DLite data on.)  
18:57:50 Counted 2 strikes in that horseshoe-shaped penetration. Total of 3 strikes today.  
18:57:59 Cycled the data to give us penetration #6. We have had very few cloud exits today.  
18:58:06 That well-defined channel I saw, I didn't see attach. It was close enough to see the outline of it. Just a little thin line.  
18:58:29 Camera on. (External movie camera on.)  
18:58:30 In light to moderate turbulence, moderate rain.  
18:58:34 Heading 300°, 18,000 ft, Penetration #6.  
18:58:42 Rain and turbulence are both light.  
18:58:51 Going to moderate rain, light to moderate turbulence.  
18:58:53 Nearby flash.  
18:58:54 And another.  
18:58:59 Getting much darker.  
18:59:00 Another nearby flash.  
18:59:09 Lots of good side-to-side turbulence.  
18:59:12 1000 ft /min downdraft.  
18:59:25 Good strike!  
18:59:25.1 (DLite LeCroy triggers 1,2, and 4. Cockpit video and external movie camera record a strike.)  
18:59:26 Excellent direct strike! Lots of flashes over the canopy. 4 triggers.  
18:59:32 I saw that one. (Observer)  
18:59:34 That was a good bright one.  
18:59:56 METRO: Again, that showed up on Ex.

18:59:58 That was a very bright and well-defined strike. Lots of  
filaments back over the canopy.  
19:00:08 Camera off. (External movie camera off.)  
19:00:42 (AIS and DLite data on.)

## AIS Record 9 - Penetration #7, 18,000 ft, 065°.

19:01:00 (AIS and DLite data on.)  
19:01:02 Cycle data for penetration #7, 18,000 ft.  
19:01:20 Roll-out heading is 065°.  
19:01:32 Camera on. (External movie camera on.)  
19:01:33 Nearby flashes on left side.  
19:01:38 More flashes overhead.  
19:01:42 Other conditions are light.  
19:01:51 Tilt has been 0° for last 30 minutes, or so.  
19:02:01 In light rain and light to moderate turbulence.  
19:02:03 Nearby flash.  
19:02:07 Very close flash.  
19:02:13 I think that may have been strike. A well defined channel on the  
left side.  
19:02:16 I think we may have had a cloud-to-ground go down the left side  
and we didn't hit it. That was interesting.  
19:02:21 METRO: We saw it on the field mill.  
19:02:24 In light to moderate turbulence and moderate rain.  
19:02:28 I saw something just come by the canopy. On the right side.  
19:02:32 I think we had another channel to go down. Miss us on the right  
side that time.  
19:02:37 Nearby flashes overhead.  
19:02:40 Those were 2 distinct channels.  
19:02:42 Yep. I didn't see the one on the right as being distinct, but I  
did see it enough to identify, but not actually see the shape of  
it.  
19:02:50 One on left was very distinct.  
19:03:00 Nearby flashes left.  
19:03:01 We're out of the cloud.  
19:03:03 Camera off. (External movie camera off.)  
19:03:05 (Event for cloud exit.)  
19:03:12 (AIS and DLite data off.)

## AIS Record 10 - Penetration #8, 18,000 ft, 190°.

19:04:18 SPANDAR: Level 6, bearing 225°, (unreadable) miles.  
19:04:25 Roger that's off the right side of our nose.  
19:04:30 (AIS and DLite data on.)  
19:04:31 Penetration #8, 18,000 ft, heading 190°.  
19:04:40 Camera on. (External movie camera on.)  
19:04:42 We are out of film. (External movie camera out of film.)  
19:04:48 In moderate turbulence, light to moderate rain.  
19:04:54 Excellent side-to-side gust.  
19:04:56 Nearby flashes.  
19:04:59 Continuous moderate rain.  
19:05:05 Only light turbulence, however.  
19:05:10 Burst of heavy rain.  
19:05:15 1000 ft /min. updraft.

19:05:17 Nearby flash.  
19:05:31 Down to moderate rain and light to moderate turbulence.  
19:05:40 In heavy rain now.  
19:05:53 Rain and turbulence off to light.  
19:05:57 Turning right to a new cell.  
19:06:18 Moderate turbulence, light rain.  
19:06:45 17 miles out.  
19:07:20 (AIS and DLite data off.)

19:07:23 Data off.  
19:07:43 Been a fairly worthwhile altitude.  
19:08:02 METRO: They (SPANDAR) need two more minutes on RHI.

AIS Record 11 - Penetration #9, 18,000 ft, 100°.

19:09:46 Data on.  
19:10:00 (AIS and DLite data on.)  
19:10:01 Penetration #9, 18,000 ft., 100°.  
19:10:13 Lots of red ahead. Green, yellow and red.  
19:10:19 SPANDAR: Level 5, 090°, 5 miles.  
19:10:29 Will pass to southeast of that particular cell.  
19:10:34.1 (DLite LeCroy triggers 1,2 and 4. Strike.)  
19:10:38 Light turbulence and no rain.  
19:10:44 We just got triggers.  
19:10:46 METRO: You got a strike and triggers.  
19:10:48 A good one! (Cockpit video records a strike.)  
19:10:49 We got a huge strike after you called, but not with the triggers.  
19:10:54 METRO: They just rearmed.  
19:10:55 Too late for that one. Too bad. That was...  
19:10:59 Triggers, and then a strike - a big one.  
19:11:01 Video got it, anyway.  
19:11:09 Nearby flashes on the left.  
19:11:11 Moderate turbulence and light rain.  
19:11:17 Nearby flashes.  
19:11:22 Moderate rain, moderate turbulence.  
19:11:25 I'd call that heavy rain, still moderate turbulence.  
19:11:31 Sounds like hail.  
19:11:34 Very heavy rain. (Audible on tape)  
19:11:37 It's at least heavy rain. Nearby flashes.  
19:11:44 Nearby flashes overhead.  
19:11:46 Again, very heavy rain - a burst.  
19:11:50 Falling off to moderate rain.  
19:11:52 Continuous moderate turbulence.  
19:12:03 Just about over Mobjack Bay. 25 miles from home.  
19:12:23 We have peeled some stuff back on the radome. I can see from here. Peeled some covering.  
19:12:25 (Event for cloud exit.)  
19:12:28 (AIS and DLite data off.)  
  
19:12:44 How do the diverter strips look?  
19:12:48 I can't quite see them, but I can see that the black covering is rolled back.  
19:12:58 We don't want to fly through much more rain as heavy as that, I guess.

19:13:07 SPANDAR: That area, level 5 and level 6 due west your position  
-5 miles, we show a little level 6 at times.  
19:13:25 Going to go on the northwest side of that.

AIS Record 12 - Penetration #10, 18,000 ft., 290°.

19:13:30 Data on.  
19:13:39 Penetration #10, 18,000 ft , 290°.  
19:13:47 Light turbulence, light rain.  
19:13:48 Nearby flash.  
19:13:50 (AIS and DLite data on. Time code stable.)  
19:13:57 Nearby flash.  
19:14:00 And another.  
19:14:02 And yet another.  
19:14:04 And almost continuous nearby flashes.  
19:14:09 More nearby flashes in clusters.  
19:14:15 Nearby flash.  
19:14:25 More nearby flashes in a cluster.  
19:14:28 Bunches of them.  
19:14:35 Calm and dry right now.  
19:14:42 Nearby flashes all around us.  
19:14:53 Flashes ahead.  
19:15:07 (180° turn to left.)  
19:16:22 Cycle data. (AIS and DLite data off.)

AIS Record 13 - Penetration #11, 18,000 ft, 165°.

19:16:26 On.  
19:16:28 Zero tilt.  
19:16:39 SPANDAR: 080° your position.....  
19:16:40 (AIS and DLite data on. Time code stable.)  
19:16:48 You're weak and broken, but that cell's off the left side.  
19:16:50 Penetration #11, 18,000 ft , 165°.  
19:17:13 Calm and dry now.  
19:17:34 Good vertical development.  
19:17:35 Light rain.  
19:17:36 Now moderate rain.  
19:17:43 Moderate turbulence, moderate rain.  
19:17:48 Cloud exit.  
19:17:50 (Event for cloud exit.)  
19:17:54 (AIS and DLite data off.)

AIS Record 14 - Penetration #12, 18,000 ft., 060°.

19:18:50 Data on.  
19:18:55 We'll get this one in the turn, even though it's not the one he's  
interested in.  
19:18:59 Penetration #12, 18,000 ft.  
19:19:00 (AIS and DLite data on. Time code stable.)  
19:19:06 Light rain, light turbulence.  
19:19:12 Very bright through here.  
19:19:22 Moderate turbulence as we continue our turn to the right.  
19:21:20 METRO: 020° - level 5 (relayed from SPANDAR, that was breaking  
up.)

19:21:24 That's off to the left. We're going to penetrate on the southeast margin.  
19:21:30 In continuous moderate turbulence and light to moderate rain.  
19:21:33 Getting much darker now.  
19:21:35 See some nearby flashes.  
19:21:37 More nearby flashes.  
19:21:43 Close flashes ahead.  
19:21:47 Close flashes overhead.  
19:21:50 Excellent side-to-side burst of turbulence.  
19:21:53 Very close flash ahead.  
19:21:54 Moderate rain.  
19:22:00 I'd call that heavy rain.  
19:22:01 Now in heavy rain.  
19:22:06 Big updrafts.  
19:22:08 1500 ft/min updrafts, and turbulence at the top.  
19:22:13 Rain drops off to nothing and continuous moderate turbulence.  
19:22:35 Partial cloud exit.  
19:22:48 (Begin left 180° turn.)  
19:22:51 Stuff has peeled back all the way almost to the juncture of the fuselage and radome.  
19:22:58 METRO: Say fuel state and weapons bay.  
19:23:02 Fuel about 5000 lbs., and off-scale on bottom, temperature-wise.  
19:23:08 Moderate turbulence and moderate rain.  
19:23:13 Want to consider terminating because of the radome?  
19:23:15 Yes, after this penetration. I don't know what it is doing to the covering. Also, there might be some pitting once the covering is gone.  
19:23:27 Metro, we are going to terminate after this penetration. We've had covering, the black covering on the radome, roll back on a couple of, at 10 o'clock and 2 o'clock. We might be getting some pitting from rain erosion underneath that.  
19:23:42 METRO: We agree.  
19:23:52 (AIS and DLite data off.)  
  
AIS Record 15 - Penetration #13, 18,000 ft , 235°.  
  
19:23:55 METRO: Present position, 10 miles, level 6.  
19:24:04 We're steady 235°. We're going to fly the yellow/red boundary on the northwest corner.  
19:24:10 (AIS and DLite data on.)  
19:24:14 Data cycled for penetration #13, 18,000 ft , 235°.  
19:24:22 Lots of nearby flashes. Almost continuous around us.  
19:24:27 In light rain, continuous light turbulence.  
19:24:33 Rain going to moderate, still light turbulence.  
19:24:37 Nearby flash.  
19:24:38 Very close flash.  
19:24:42 More nearby flashes, and some more.  
19:24:50 Close flashes.  
19:24:58 More nearby flashes.  
19:25:09 Nearby flashes.  
19:25:31 Start descending here. We'll pick up these cells enroute.  
19:26:17 Burst of moderate rain.  
19:26:23 Moderate turbulence, moderate rain as we descend through 16,000 ft.

19:26:27 I'd say that was more than moderate turbulence.  
19:26:30 Right there it was.  
19:26:31 In heavy turbulence.  
19:26:32 Cloud exit.  
19:26:34 (Event for cloud exit.)  
19:26:40 (AIS and DLite data off.)

AIS Record 16 - DLite LeCroy Cals.

19:27:50 (AIS and DLite data on.)  
(Two sets of cals.)  
19:29:32 We also have something loose on the center post between the two  
wind screens, flapping. Looks like a seal, or something.  
19:29:33 (AIS and DLite data off.)

(Run out DLite tapes without running AIS.)

AIS Record 17 - Landing.

19:34:50 (AIS data on.)  
19:35:47 (Landing.)  
19:36:43 (AIS data off.)  
  
19:37:37 (Cockpit voice recorder off.)  
19:37:44 (Radar video recorder off.)

AIS Record 18 - Chocks.

19:39:20 (AIS data on.)  
19:40:21 (AIS data off.)  
  
(DLite instrumentation off.)  
(DLite master power off.)



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-035 F-106B

Date July 16, 1984

Crew Brown/Fisher

Engine Start 18:09:29

Take-off 18:24:40

Landing 19:35:47

Lightning Systems:

Dlite 5 Triggers

40ns LeCroy I.1  $\dot{I}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10 ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

Non-Lightning Systems:

AIS No Vanes.

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

Aft movie camera 4 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 5 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK. But randome paint eroded.

Wire mesh OK

Stormscope Aft INOP 0.5 INOP

Region Hopewell, VA

Pens 13

Strikes 7

Nearbys 0

## Ground-Based

## Wallops

## Telemetry

Strip Charts OK

PCM Data OK

## Kavouris System

Basic Display OK

INS Overlay OK

Triggers OK

Videotape OK

Satellite Pictures OK

SPANDAR

Videotape OK

Digital dBZ Tape OK

LDAR                      PINOP

UHF Radar            OK

C-Band Tracking OK

Goddard Antennas OK

GSFC                      NU

WFF OK

LaRC                      NI

ELF Antenna NI

LLP OK

WFF Plots OK

LaRC Plots OK

WFF Tape OK

Debrief Notes for Flight 84-036, July 24, 1984

Storm Flight/Tri County Airport, NC

Brown/Winebarger

GMT

AIS Record 1 - Cockpit Video check.

19:49:00 Engine start.

AIS Record 2 - Takeoff.

20:09:50 (AIS data on.)

20:10:15 (Liftoff.)

20:10:53 (AIS data off.)

20:18:55 Tilt -5°.

20:18:57 I saw a flash. Although it doesn't show up much on radar we know we got something in there.

AIS Record 3 - Penetration 1.

20:19:29 Data is on.

20:19:35 (Event - storm entry.)

20:19:39 Cloud entry.

20:19:40 (Data on.)

20:19:42 METRO: Field mill activity.

20:20:02 Altitude 248.

20:20:26 Precip and moderate turbulence.

20:20:39 Heading on 250°.

20:20:45 Bright flashes and precip.

20:20:48 METRO: Strike with triggers.

20:20:50 Didn't show up here.

20:20:54 METRO: Correction - a camera flash, not a strike.

20:21:01 (Event - cell exit.)

20:21:05 We broke out and are heading for another cell in front of us.

20:21:14 METRO: Looks like you ought to go higher.

20:21:17 How much?

20:21:19 METRO: 5,000 ft.

20:21:55 I don't see anything on this radar. I think it has gone flakey on us. I'm looking all way down - there's something.

20:22:18 (Event - second cell entry.)

20:22:55 (Event - cell exit.)

20:22:56 (Data off.)

20:24:24 0° tilt.

20:24:26 -2°.

20:24:30 Any stormscope?

20:24:32 Got one dead ahead.

20:25:02 -4° tilt.  
20:25:04 METRO: UHF advises tops are in vicinity of 33k.  
AIS Record 4 - Penetration 2.  
20:25:10 (Data on.)  
20:25:11 Data is on for penetration 2.  
20:25:18 -5° tilt.  
20:25:20 (Event - storm entry.)  
20:25:23 Cloud entry.  
20:25:28 Heading 065°, altitude 30,000.  
20:25:32 Pretty good turbulence.  
20:25:42 Getting some precip.  
20:25:48.5 (All LeCroys triggered and cockpit video recorded strike.)  
20:25:49 Flashes.  
20:25:53 METRO: .....triggers.  
20:25:55 We saw triggers but didn't see a strike.  
20:25:58 We saw a nearby.  
20:26:49 (Event - storm exit.)  
20:26:50 (Data off.)  
20:28:58 -5° tilt.  
AIS Record 5 - Penetration 3.  
20:29:32 (Event - storm entry.)  
20:29:36 Back in cloud for penetration 3 but the contour is still  
6 miles ahead. Heading 240°. Altitude 30,000.  
20:29:40 (Data on.)  
20:29:52 0° tilt.  
20:29:56 -2° tilt.  
20:30:30 Light precip, moderate turbulence.  
20:30:34 Little heavier precip now.  
20:30:50.1 (All LeCroys triggered.)  
20:30:54 METRO: Triggers 816?  
20:30:57 (Event - storm exit.)  
20:31:01 I saw them but I don't know what did it. Didn't see a  
flash at all that penetration.  
20:31:09 METRO: We saw a real large field, a charge on the airplane.  
20:31:16 METRO: Might have had a big corona discharge.  
20:31:19 (Data off.)  
20:31:20 We got a little static. A couple of clicks of static.  
AIS Record 6 - Penetration 4.  
20:32:30 (Data on.)  
20:32:34 Have data on for penetration 4. Coming around to penetration  
heading, 30,000 on altitude.  
20:32:52 Heading 120°.  
20:33:24.1 (All LeCroys triggered.)  
20:33:27 Good bump and precip.  
20:33:29 METRO: We see triggers.  
20:33:30 (Aft camera and cockpit video recorded strike.)  
20:33:35 Strike after they triggered.  
20:33:38 That was a nice bright one.  
20:33:40 Metro, Field mills looked like two strikes.

20:33:45 (Event - storm exit.)  
20:33:49 We're out.  
20:33:54 (Data off.)

## AIS Record 7 - Penetration 5.

20:35:54 Data is on for penetration 5, altitude 29-5. About 270° heading.  
20:36:00 (Data on.)  
20:36:06 (Event - storm entry.)  
20:36:08 We're in the storm.  
20:36:25 -2° tilt.  
20:36:40 Precipitation and turbulence.  
20:36:46 Good updraft.  
20:37:35 (Event - storm exit.)  
20:39:00 METRO: See if you can get down to 27,000 or as low as you can, quick.  
20:39:30 0° tilt.  
-6 tilt.

## AIS Record 8 - Penetration 6.

20:40:29 (Event - storm entry.)  
20:40:30 (Data on.)  
20:40:32 Data is on for penetration 6, heading 070°, altitude 29,000.  
20:40:40 In some stuff, a little turbulence, that doesn't even show on the radar.  
20:40:50 -2° tilt.  
20:40:58 A distant flash.  
20:41:03 -2° tilt.  
20:41:11 Light precipitation and light turbulence.  
20:41:48 (Event - storm exit.)  
20:42:00 (Data off.)  
20:42:12 I think we should have seen more on radar than we did from that, there was rain. We usually see something, anytime we hit rain.  
20:43:35 We should see something on there. See those specks at 7 miles. That's negative 2°. 04° next. Just barely a couple little pixels. Maybe a half dozen and they are scattered.  
20:43:53 -5°.  
20:43:57 -7°.  
20:44:02 Not doing any better at -7° back to -2°.

## AIS Record 9 - Penetration 7.

20:44:10 (Data on.) Data is on and we're entering the clouds for penetration 7. Heading 290°, altitude 29.  
20:44:34 Light precipitation.  
20:44:35 -2° tilt.  
20:44:47 Distant flash.

20:45:44 (Event - storm exit.)  
 20:45:49 (Data off.)  
 20:47:04 -2° - nothing.  
 20:47:08 -5° - all I see is return at 17 miles.

AIS Record 10 - Penetration 8.

20:47:50 (Data on.)  
 20:47:51 Data is on for penetration 8, heading 120°, 27,000 ft. In the storm. Light turbulence. Nothing showed on the radar for this storm, this time.  
 20:48:04 METRO: Go down lower. 26.  
 20:48:14 Getting some light turbulence through it.  
 20:49:02 -5° on tilt still.  
 20:49:10 Some rain.  
 20:49:23 (Event - storm exit.)  
 20:49:30 (Data off.)  
 20:49:34 METRO: How does radome look?  
 20:49:44 From what I see it looks like what it did when I taxied out.  
 20:50:12 -5°.  
 20:50:20 -2°.  
 20:50:24 -5°.

AIS Record 11 - Penetration 9.

20:50:50 Data on for penetration 9, 45° heading, altitude 26.  
 20:51:00 (Data on.)  
 20:51:02 (Event - storm entry.)  
 20:51:03 We're in the storm.  
 20:51:21 Light precipitation.  
 20:51:24 Good updraft.  
 20:52:00 (Event - storm exit.)  
 20:52:01 We're out and I didn't see a flash.  
 20:52:12 (Data off.)  
 20:52:38 -2° on tilt.

AIS Record 12 - Penetration 10.

20:53:40 (Data on.)  
 20:53:42 Penetration 10, heading 145, altitude 26,000.  
 20:53:54 (Event - storm entry.)  
 20:53:55 We're in the cell.  
 20:54:04 Precipitation, light turbulence.  
 Distant flash.  
 20:54:11 (Event storm exit.)  
 20:54:12 We're out.  
 20:54:14 (Data off.)  
 0° tilt.

AIS Record 13 - Penetration 11.

20:57:23 Data on penetration 11, Heading 315°, altitude 26,000.  
20:57:30 (Data on.)  
20:57:40 (Event - storm entry.)  
20:57:54 Good bounces there.  
20:58:10 (Event - storm exit.)  
20:58:13 We're out.  
20:58:15 (Data off.)  
-2°.  
0°.  
-5°  
20:59:18 Got some stormscope activity on that one.

## AIS Record 14 - Penetration 12.

21:00:00 (Data on.) Data is on for penetration 12. We're in the storm  
heading 225°, altitude 26,000,  
21:00:18 Static.  
21:00:25 Light precip.  
21:00:36 Light turbulence.  
21:00:41 (Event - cell exit.)  
21:00:42 We're out.  
21:01:24 We're back in. (Event - 2nd cell entry.)  
21:01:44 Light precip.  
21:01:46 Distant flash.  
21:02:00 Pretty good bumps there.  
21:02:26 (Event - cell exit.)  
21:02:30 (Data off.)  
21:02:39 -2°.  
21:03:04 -5°.  
21:03:09 -2°.  
21:04:07 (Storm off tracking..)  
21:04:41 -5°. Got 2 cells.

## AIS Record 15 - Penetration 13.

21:05:00 (Data on.) Data on for penetration 13. In cloud part.  
A few miles to contour. Heading 080°, altitude 26,000.  
21:05:33 Getting some updrafts and some precip.  
21:06:53 (Event - storm exit.)  
21:06:55 (Data off.)

## AIS Record 16 - Penetration 14.

21:09:06 Back in the storm. Heading 315°, altitude 28,000, penetra-  
tion 14.  
21:09:10 (Data on.)  
21:09:17 Light precip.  
21:09:45 That about it.  
21:10:21 (Event - storm exit.)  
21:10:25 (Data off.)  
21:12:02 -2°.  
21:12:08 0° Looks better than anything we've seen.

21:12:15 (Spandar says storm near Elizabeth City 41000. 2/minutes.)  
21:13:18 Under blow off to storm now.  
21:13:40 Stormscope activity too.

## AIS Record 17 - Penetration 15.

21:13:45 Bring data on.  
21:14:10 (Data on.)  
21:14:20 (Aft camera and cockpit video recorded strike.)  
21:14:21 Strike.  
21:14:22 No triggers.  
21:14:29 A good strike to the nose.  
21:14:34 Didn't trigger.  
21:14:43 Distant flashes.  
21:14:46 Good precip.  
21:14:48 Turbulence.  
21:14:51 Close flashes.  
21:15:04 And we're out.  
21:15:06 Hey! Nice one!  
21:15:08 (Data off.)  
21:15:10 Did it trigger?  
21:15:12 No - it was below us.  
21:15:26 A real bright one below us after we exited the storm.  
21:16:16 The strike was just prior to hitting the heavy precip and turbulence.

## AIS Record 18 - Penetration 16.

21:16:50 (Data on.)  
21:17:00 Data on penetration 16, 270° heading, altitude 27,000, climbing to 28.  
21:17:18 (Event - storm entry.)  
21:17:19 In storm.  
21:17:22 3,000 ft/minute up.  
21:17:26 (All LeCroys triggered Aft camera recorded two events and cockpit video recorded strike.)  
21:17:27 Good strike with triggers.  
21:17:30 Two strikes one right after the other.  
21:17:36 Two channels a bright one then a dimmer one.  
21:18:00 (Event - storm exit.)  
21:18:09 (Data off.)

## AIS Record 19 - Penetration 17.

21:20:04 Data is on penetration 17. Heading 100°, going back up to 28.  
21:20:39 In the storm.  
21:20:57.3 (All LeCroys triggered. Aft camera and cockpit video recorded strike.)  
21:20:59 Flashes and triggers.  
21:21:10 We're out. (Event - stormscope.)



21:21:19 (Data off.)

AIS Record 20 - Penetration 18.

21:23:10 (Data on.)

21:23:12 Penetration 18, heading 265°, altitude 29.

21:23:40 We're in the storm.

21:23:55 Precip and light turbulence.

21:24:40 (Storm exit.)

21:25:30 165° at 22 from Franklin.

21:25:58 (Data off.)

AIS Record 21 - Penetration 19.

21:27:40 (Data on.) We're in the cloud with data on for penetration.  
19. Altitude 29,000 ft, heading 70°.

21:28:53 Distant flash.

21:29:06 We're out.

21:29:26 (Data off.)

AIS Record 22 - Penetration 20.

21:31:09 Got some good turbulence there. We're back in.

21:31:10 (Data on.)

21:31:11 Direct strike - penetration 20 - strike with triggers.

21:31:11 (All LeCroys triggered and AFT camera recorded strike.)

21:31:40 At that strike we had heavy turbulence and light precip.

21:32:11 (Event - storm exit.)

AIS Record 23 - DLite Cals.

21:33:10 (Data on.)

21:34:30 (Data off.)

AIS Record 24 - Landing.

21:48:10 (AIS data on.)

21:49:02 (Touchdown.)

21:50:04 (AIS data off.)

AIS Record 25 - Chocks.

21:52:50 (AIS data on.)

21:53:36 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-036 F-106B

Date July 24, 1984

Crew Brown/Winebarger

Engine Start 19 :49 :00

Take-off 20 :10 :15

Landing 21 :49 :02

Lightning Systems:

Dlite 6 Triggers

40ns LeCroy I.1  $\int D_F$  2  $I_N$  3  $I_T$

5ns LeCroy II.1  $D_T$  2  $I$  3  $B_L$

10ns LeCroy III.1  $I_{NOP}$  2  $D_{W,L}$  3  $D_F$

5ns LeCroy IV.1 TP1002TP101 3 TP123

Digital Peak Counter 1  $I=X$  2  $D_F=X$

Non-Lightning Systems:

AIS No vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 5 Strikes. Auto. 128 pps.

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video NG - Overexposed

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP.Minor attachments

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Tri-County A/P. NC

(Ahoskie)

Pens 20

Strikes 9

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 036

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_

Videotape \_\_\_\_\_ PINOP \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ PINOP \_\_\_\_\_

LDAR \_\_\_\_\_ INOP \_\_\_\_\_

UHF Radar Real time only \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ NU \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC NU - Out of range \_\_\_\_\_

WFF NU - Out of range \_\_\_\_\_

LaRC SLOW E. \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NI \_\_\_\_\_

LLP PINOP (Dahlgren down) \_\_\_\_\_

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ OK \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

Debrief Notes for Flight 84-037, July 25, 1984

Storm Flight/New Bern, N.C.

Brown/Rondeau

GMT

18:47:00 (Engine start.)

AIS Record 2 - Takeoff

19:02:10 (AIS data on.)

19:02:47 (Takeoff.)

19:04:15 (AIS data off.)

AIS Record 3 - DLite LeCroy calcs.

19:11:00 (AIS and DLite data on.)

19:11:32 (Three sets of LeCroy calcs.)

19:13:19 (AIS and DLite data off.)

AIS Record 4 - DLite LeCroy calcs.

19:13:40 (AIS and DLite data on.)

19:13:46 (Three sets of LeCroy calcs.)

19:15:50 (AIS and DLite data off.)

AIS Record 5 - Penetration #1.

19:24:50 (AIS data on. DLite data did not come on.)

19:25:44 Penetration 1. Slight turbulence.

19:26:12 (Hear static and they get triggers, but don't see anything else.)

19:26:13 (DLite LeCroy triggers 1-4. No data.)

19:26:31 Moderate turbulence. Nearby flashes.

19:26:32 (Cockpit video records a strike.)

19:26:46 Rain.

Nearby flashes.

Heavy rain.

(DLite LeCroy triggers 1-4. No data.)

19:26:51 (Cockpit video records a strike.)

19:26:54 Got triggers. Saw nearby.

At 39,000 ft. Nearby flashes.

19:27:08 Heading 280°.

19:27:15 Moderate turbulence, rain.

19:27:27 Heavy rain.

19:27:53 (DLite LeCroy triggers 1-4. No data. Cockpit video records a strike.)

19:27:54 Good strike, left side (of nose).

Got triggers.

19:28:05 Heading 330°, 38,000 ft.

Strike was on left side of nose.

19:28:40 Heavy turbulence.

Rain. (DLite LeCroy triggers 1-4. No data.)  
19:28:46 Camera switch is on, and I just got triggers.  
19:28:50 (Cockpit video records a strike.)  
19:28:52 Good strike, nose.  
19:28:55 Good strike, nose.  
19:28:58 Another strike, nose.  
19:29:07 Neither of last two on tape. DLite hadn't rearmed.  
19:29:16 Another strike to nose. (DLite LeCroy triggers 1-4. No data.  
Cockpit video records a strike.)  
We got triggers.  
19:30:09 (Discussion of number of strikes. Field mills had shown 10. Had  
called 4 (miscount-actually called 5.)  
19:30:45 Airspeed icing up on us now.  
19:31:10 Getting ready to make second penetration.  
19:31:22 (AIS and DLite data off.)

## AIS Record 6 - Penetration #2.

19:31:38 (DLite LeCroy triggers 1-4. No data, cockpit video records a  
strike.)  
19:31:39 Strike to nose boom.  
19:31:40 (AIS data on. Time code stable. DLite data did not come on.)  
19:31:45 We are getting little tiny arcs off the nose boom.  
19:31:50 I had something flying around the cockpit.  
19:32:00 METRO: We saw triggers when you turned the data back on.  
Right.  
METRO: Strike?  
19:32:06 Yes.  
I don't think I had data on long enough to pick it up, though, at  
least not all of it.  
19:32:20 Moderate turbulence.  
19:32:40 You can definitely call this moderate to heavy turbulence.  
(DLite LeCroy triggers 1-4. No data. Cockpit video records a  
strike.)  
19:32:44 I just got triggers.  
19:32:45 (Cockpit video records a strike.)  
19:32:47 Strike to left side.  
Strike to nose boom.  
19:32:58 (Cockpit video records a strike.)  
19:32:59 Another strike - right side. (External movie camera triggers  
automatically.)  
19:33:00 (Cockpit video records a strike.)  
19:33:01 Another one. (Cockpit video records a strike.)  
19:33:02 Another one. (Cockpit video records a strike.)  
19:33:03.1 (DLite LeCroy triggers 1-4. Recorders now operating. External  
movie camera triggers automatically. Cockpit video records a  
strike.)  
19:33:05 (External camera triggers automatically.  
19:33:07 Got triggers on that one. (External camera triggers  
automatically.)  
19:33:12 Another one.  
They hadn't rearmed.  
19:33:16 Heavy rain.  
19:33: Altitude 38,800 ft., heading 290°.

19:33:53 Nearby.  
Nearby flashes.  
19:33:55 Heavy rain.  
19:34:03 (External movie camera triggers automatically. Cockpit video records a strike.)  
19:34:07 More nearbys.  
19:34:10 Moderate to heavy turbulence.  
19:34:11 .....didn't see it.  
19:34:13 Triggers?  
No.  
19:34:13.6 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:34:16 Now I have triggers.  
19:34:19 There's something else.  
19:34:20 Another strike.  
19:34:21 (Cockpit video records a strike.)  
19:34:25 (Cockpit video records a strike.)  
19:34:28 I saw a strike go down the top of the canopy.  
19:35:16 Going to turn data off for a second to show another penetration.  
19:35:18 (AIS and DLite data off.)

## AIS Record 7 - Penetration #3.

19:36:10 (AIS and DLite data on.)  
19:36:11 This line is almost east-west.  
19:36:20 Penetration #3.  
19:36:27 They are coming so fast, I can't count them, and I don't know if we are getting triggers on all of them, or not.  
19:37:26 Another situation where I am losing altitude. Everything is frozen: Angle of attack and airspeed-frozen. All we got now is altitude. Still losing altitude.  
19:38:16 On some of those strikes, did you hear things popping in the cockpit?  
19:38:22 I heard some noises that I associated with the strike. I didn't hear anything in the cockpit.  
19:38:28 There was something back here with me.  
19:38:37 Going to fly this on the edge.  
19:38:56.8 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:38:57 Strike-right side.  
Got triggers.  
19:39:08 Heading 260°, altitude...  
19:39:11 Strike-left side.  
19:39:15 Another strike-right side.  
19:39:15.1 (DLite LeCroy triggers 1-4.)  
19:39:22 (Cockpit video records a strike.)  
19:39:26 Triggers had not rearmed yet.  
19:39:29 (Cockpit video records a strike.)  
19:39:31 Another strike-left side.  
19:39:36 (External movie camera triggers automatically. Cockpit video records a strike.)  
19:39:37 Another - 2 or 3 strikes.  
19:39:38.6 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:39:41 Another strike.  
19:39:42 I got triggers.  
19:39:45 (External movie camera triggers automatically. Cockpit video

records a strike.)  
19:39:47 Another strike-left side.  
19:39:50 Another strike. (Cockpit video records a strike.)  
19:39:53 (External camera triggers automatically. Cockpit video records a strike.)  
19:39:54 Another strike.  
19:40:07 (Cockpit video records a strike.)  
19:40:08 Nearby flashes.  
19:40:16 Very light turbulence.  
19:40:17.4 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:40:19 Strike and triggers.  
19:40:22 Another strike-left side.  
19:40:35.5 (DLite LeCroy triggers 1-4. DLite data indicate a strike.)  
19:40:39 (External camera triggers automatically. Cockpit video records a strike.)  
19:40:41 Strike-right side, got triggers.  
19:40:45 (External movie camera triggers automatically. Cockpit video records a strike.)  
19:40:51 (Cockpit video records a strike.)  
19:40:52 Another strike-left side.  
Another strike. (External camera triggers automatically.)  
19:40:57.8 (External camera triggers automatically. DLite LeCroy triggers 1-4.)  
19:40:58 Another strike - 2 or 3.  
19:41:02 Lots of nearbys.  
19:41:05 (External camera triggers automatically. Cockpit video records a strike.)  
19:41:14 Rain, moderate turbulence.  
19:41:22 Heading 260°, altitude 38. (FL380)  
19:41:27 Nearby.  
Nearby flashes.  
19:41:37 Rain.  
19:42:05 Angle of attack unfrozen, but airspeed still frozen.  
19:42:32.8 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:42:33 Strike.  
Got triggers.  
19:42:40 Heading 340°, altitude 38 (FL380).  
19:42:50 Another strike-right side.  
No triggers. Hadn't rearmed. (Cockpit video records a strike.)  
19:44:11 Data off for a second.  
19:44:12 (AIS and DLite data off.)  
19:44:19 Ready to make penetration 4.  
  
AIS Record 8 - Penetrations #4 and 5.  
  
19:44:20 (AIS and DLite data on.)  
19:44:51 Altitude 38 (FL380), Heading 100°.  
METRO: And fuel state?  
Stand by on the fuel.  
19:45:25 (Cockpit video records a strike.)  
19:45:28 Strike-right side.  
No triggers.  
19:45:41 (Cockpit video records a strike.)

19:45:42 Strike-nose.  
19:45:52 Moderate turbulence.  
19:45:55 Altitude 37. (FL370)  
19:46:01 It's 38. We're climbing back up, or trying to.  
19:46:05 -2° tilt.  
19:46:16 Got screwed up fuel gauge.  
Airspeed is iced up.  
19:46:21 Heavy turbulence.  
19:46:30 Might have gotten strike. Little thin filament. (Cockpit video records a strike.)  
19:46:33 (External movie camera triggers automatically. Cockpit video records a strike.)  
19:46:34 There's a strike.  
19:46:37 Another strike.  
No triggers.  
19:46:51 Heading 070°. (External movie camera triggers automatically. Cockpit video records a strike.)  
19:46:52.8 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:46:55 Lots of nearby flashes.  
19:46:59 (External movie camera triggers automatically.  
19:47:00 Strike and triggers.  
19:47:13.7 (DLite LeCroy triggers 1-4. External movie camera triggers automatically. Cockpit video records a strike.)  
19:47:18 Rain. (External movie camera triggers automatically.)  
19:47:28 Altitude 39. Heading 080°.   
19:47:32.8 (DLite LeCroy trigger 4 only. Cockpit video records a strike.)  
19:47:35 Strike-left side.  
Hadn't rearmed.  
19:47:38 (Cockpit video records a strike.)  
19:48:21 Showing 5.5 fuel. About what it should be.  
19:48:34.8 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:48:35 Good golly!  
Good strike and got triggers.  
19:48:53.6 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:48:54 (External movie camera triggers automatically.)  
19:48:57 Nearby flashes, rain.  
19:48:59 (Cockpit video records a strike.)  
19:49:02 Strike-right side. (External movie camera triggers automatically. Cockpit video records a strike.)  
19:49:06 (Cockpit video records a strike.)  
19:49:09 Nearby.  
19:49:22.9 (DLite LeCroy triggers 1-4. DLite data indicate a strike.)  
19:49:27 METRO: Triggers, 816. Did you see a strike with that?  
I didn't see a strike, but I got a trigger.  
19:50:37 METRO: 151 miles from here.  
19:51:18 Angle of attack periodically freezes up. It is frozen up now.  
19:52:40 In light to moderate turbulence. In the clouds.  
19:52:53 Will make this westerly pass the last before RTB.  
19:53:03 Penetration #5.  
19:53:19 (Event to end penetration #4, begin penetration #5.)  
19:54:00 Try to struggle back up to 29-should be saying 39.  
19:55:06.6 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:55:07 Good strike-right side.  
Got triggers.



19:55:14 (Cockpit video records a strike.)  
19:55:14.5 (Cockpit video records a strike.)  
19:55:16 Good strike-right side.  
19:55:26.3 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:55:27 Strike 2...3  
19:55:29 Big strike.  
19:55:36 (External movie camera triggers automatically.)  
19:55:37 There's strike-another one.  
19:55:48 Altitude 38, heading 280°.  
19:56:22 Running full military power. I don't have any airspeed I can trust.  
19:56:36.9 (DLite LeCroy triggers 1-4. DLite data indicate strike.)  
19:56:55 METRO: Triggers. Didn't hear you call a strike.  
19:56:59 No strike.  
19:57:11 Not able to maintain altitude here.  
19:57:44.6 (DLite LeCroy triggers 1-4. External movie camera triggers automatically twice. Cockpit video records a strike.)  
19:57:46 Strike. Got triggers.  
19:57:55 Heading 300°, altitude 35 (FL350).  
19:58:02 Nearby flashes.  
19:58:08 Light turbulence.  
19:58:19 Strike.  
19:58:19.2 (DLite LeCroy triggers 1-4. Cockpit video records a strike.)  
19:58:22 Strike with triggers.  
19:58:26 More nearby flashes.  
19:58:51 Lets knock this off and head home.  
19:59:15 (External movie camera triggers automatically.)  
19:59:19 Nearby strike, underneath, no triggers.  
20:01:37 149 to Langley.  
20:01:58 (AIS and DLite data off.)

## AIS Record 9 - DLite LeCroy calcs.

20:05:40 (AIS and DLite data on.)  
20:05:38.3 (Two sets of LeCroy calcs.)  
20:07:25 (AIS and DLite data off.)

## AIS Record 10 - Landing.

20:28:00 (AIS data on.)  
20:28:20 (Landing.)  
20:28:37 (AIS data off.)

## AIS Record 11 - Chocks.

20:33:00 (AIS data on.)  
20:34:28 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-037 F-106B

Date July 25, 1984

Crew Brown/Rondeau

Engine Start 18:47:00

Take-off 19:02:47

Landing 20:28:20

Lightning Systems:

Dlite 19 Triggers \*\*

40ns LeCroy I.1 I<sub>D</sub><sub>F</sub> 2 I<sub>N</sub> 3 I<sub>T</sub>

5ns LeCroy II.1 I<sub>D</sub><sub>T</sub> 2 I 3 I<sub>B</sub><sub>L</sub>

10ns LeCroy III.1 I<sub>D</sub><sub>W,R</sub> 2 I<sub>D</sub><sub>W,L</sub> 3 I<sub>D</sub><sub>F</sub>

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1 NI 2 NI

\*\* Turned on late.

Non-Lightning Systems:

AIS No vanes-PINOP

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera NG

Cockpit cameras

Stereo Fwd NI

Mass aft NI

Aft video 54 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP - Some damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft NU 0.5 NU

Region New Bern, NC

Pens 5

Strikes 72

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 037

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR Real Time black & WhiteVideotape NUDigital dBZ Tape NULDAR NU -Too farUHF Radar OKC-Band Tracking OKGoddard Antennas NUGSFC NUWFF NULaRC NUELF Antenna NILLP PINOP (Dahlgren down.)WFF Plots OKLaRC Plots PINOP. RDP IntermittentWFF Tape OK

STORM HAZARDS '84 AIRCRAFT SQUAWK SHEET

Flight No. 84-037

Date: July 26, 1984

1. Pitot-static iced up.
2. Fuel gauging system inaccurate during flight.

Debrief Notes for Flight 84-038, July 27, 1984

Storm Flight/Blackstone, VA

Brown/Fisher

GMT

20:01:00 (Engine start.)  
20:03:00 (DLite master power on.)

AIS Record 2 - Takeoff.

20:11:30 (AIS data on.)  
20:11:40 (Takeoff.)  
20:12:25 (AIS data off.)  
20:13:33 (DLite instrumentation on.)

AIS Record 3 - DLite LeCroy Cals.

20:14:10 (AIS & DLite data on.)  
20:14:11 (First cal. TR2 will not rearm.)  
20:15:11 (Second cal. TR2 back.)  
20:16:12 (Third cal. Normal.)  
20:16:55 (AIS & DLite data off.)  
20:20:14 (Cockpit voice recorder on.)  
20:20:20 (Radar video recorder on.)  
20:20:31 METRO: What do you see on your radar at 12 o'clock?  
20:20:35 Roger, we see 3 small cells at the time. First cell is  
about 15 miles out dead ahead all green. There's a second  
small cell 20 miles out, green and yellow, just right of  
course. And behind it at 30 miles is another green and  
yellow cell. Nothing on stormscope.  
20:21:03 0° tilt.  
20:21:51 METRO: Do you have triggers?  
20:21:54 Negative.  
20:22:26 METRO: See triggers now?  
20:22:27 10-4. We sure do.  
20:22:30 Something screwed up then.  
20:22:32 75°.  
20:22:43 They are coming back fast, which indicates thermal  
problem, but it's nice temperature down there.  
20:23:07 SPANDAR: Show level 5 about 7 miles, about 260°  
your position.

AIS Record 4 - Penetration 1, 15,000 ft, 250°.

20:23:22 Penetration 1, 15,000 ft.  
20:23:29 Cloud entry. Event.  
20:23:30 (AIS & DLite data on. Event for cloud entry.)  
20:23:31 Red's going down the right side.  
20:23:37 Some turbulence, very light rain.

20:23:40 Heading 250°.  
20:23:52 Moderate turbulence.  
20:23:54 Nearby flashes. (External movie camera triggers automatically.)  
20:23:55 Moderate rain.  
20:23:59 Heavy rain.  
20:24:00 Light turbulence.  
20:24:05 (Thermal triggers on DLite.)  
20:24:09 Rain falls off to moderate.  
20:24:10 Nearby flash.  
20:24:13 Moderate rain, moderate turbulence.  
20:24:18 Extremely bright.  
20:24:19 I saw triggers at cloud exit, but they are back very, very rapidly.  
20:24:28 (Thermal triggers on DLite.)  
20:24:29 I see triggers again. No conditions to warrant it.  
20:24:37 METRO: Recycle instrument power.  
20:24:45 At cloud exit, we will do so.  
20:24:53 (Thermal triggers on DLite.)  
20:24:56 Lots of spurious triggers.  
20:25:08 Smooth and dry at this time.  
20:25:27 Light turbulence, light rain.  
20:25:33 Moderate rain, light turbulence.  
20:25:46 Very light rain, light turbulence.  
20:25:52 SPANDAR: 250°, 12 miles your position, level 5.  
20:26:03 Getting very turbulent. In moderate turbulence.  
20:26:08 Very, very dark.  
20:26:09 Partial cloud exit between cells.  
20:26:14 -2 tilt.  
20:26:18 (Thermal triggers on DLite.)  
20:26:20 Spontaneous triggers.  
20:26:26 -4°.  
20:26:27 METRO: Confirm that the red overheat light on DLite is not on.  
20:26:30 It is not on. Temp is 74°. It's getting cooler.  
20:26:52 Calm and dry. Right wing is almost in clear. Very dark on the left.  
20:27:07 Nearby flashes.  
20:27:14 0° tilt.  
20:27:16 See only green and yellow ahead. Heading almost due west.  
20:27:20 Nearby flashes.  
20:27:34 Light rain, light turbulence.  
20:27:42 Moderate rain, moderate turbulence.  
20:27:47 1,000 ft/minute sink.  
20:27:53 Cloud exit - event.  
20:27:55 (Event for cloud exit.)  
20:28:00 Data off.  
20:28:02 (AIS & DLite data off.)  
20:28:57 (Cycle DLite instrumentation switch.)  
20:29:17 Temperature about 72°.

## AIS Record 5 - Penetration 2, 15,000 ft, 065°.

20:30:11 Penetration 2, 15,000 ft heading 065°.  
20:30:20 (AIS & DLite data on.)  
20:30:26 -1° (tilt).  
20:30:40 Cloud entry with event. (Event.)  
20:30:46 Light rain, light turbulence.  
20:31:22 (External movie camera triggers automatically.)  
20:31:23 Very close flash.  
20:31:31 Very light rain, light turbulence.  
20:31:33 Steady light rain now.  
20:31:37 Moderate rain, light turbulence.  
20:31:50 We see only green & yellow. In a left turn to line  
up with the storms.  
20:31:53 Nearby flash overhead.  
20:31:57 Another nearby flash.  
20:32:09 A couple of pixels of red at 3 miles.  
20:32:12 SPANDAR: Level 5, due north your position, 5 miles.  
20:32:19 We're going to take this down the left side. Go to the  
east.  
20:32:24 In light to moderate rain and occasional moderate turbulence.  
20:32:33 Moderate rain, light turbulence.  
20:32:38 SPANDAR: I see level 5, due east your position, very, very  
close.  
20:32:54 Light to moderate turbulence, occasional moderate rain.  
20:32:58 Left wing cloud exit.  
20:33:01 Aircraft cloud exit.  
20:33:03 (Event for cloud exit.)  
20:33:34 0° tilt.  
20:33:38 Cycle data real fast. (AIS & DLite data off.)

## AIS Record 6 - Penetration 3 &amp; 4.

20:33:57 Cycle data for penetration 3, heading east, 15,000 ft.  
20:34:00 (AIS & DLite data on.)  
20:34:08 Two little pixels of red at -2° tilt.  
20:34:15 Event cloud entry. (Event.)  
20:34:19 Moderate turbulence, light rain.  
20:34:24 Moderate rain, occasional moderate turbulence.  
20:34:33 Steady moderate rain.  
20:34:36 Heavy rain.  
20:34:48 Rain falls off to nil, only light turbulence during that.  
20:35:01 Beginning a 90° - 270°.  
20:35:26 Still in clouds.  
20:35:31 Weapon bay 70°.  
20:35:40 (Event for cloud exit.)  
20:35:55 METRO: Saw about 3 flashes on camera.  
20:36:37 Cloud entry with event. (Event.)  
20:36:42 Mark records for penetration 4, 15,000 ft, (260°).  
20:37:04 In a right turn thru west to line up with the cells.

20:37:09 Calm and dry.  
20:37:45 Moderate rain, light turbulence.  
20:37:48 Heavy rain, no turbulence.  
20:37:56 Moderate to heavy rain and light turbulence.  
20:38:05 SPANDAR: Level 5, north your position, 1 mile, south your position, 5 miles, west your position, 10 miles.  
20:38:19 Cloud exit.  
20:38:21 (Event for cloud exit.)  
20:38:41 Cycle the data.  
20:38:42 (AIS & DLite data off.)

## AIS Record 7 - Penetration 5, 15,000 ft, 210°.

20:39:00 (AIS & DLite data on.)  
20:39:01 Penetration 5, cloud entry.  
20:39:04 (Event for cloud entry.)  
20:39:08 In moderate rain, light to moderate turbulence.  
20:39:18 1,000 ft/ minute updraft.  
20:39:20 Continuous moderate rain.  
20:39:23 Light to moderate turbulence.  
20:39:25 Rain falls off to light.  
20:39:28 Extremely bright.  
20:39:31 Total cloud exit. (Event for cloud exit.)  
20:39:38 Heading about 210° that time.  
20:39:46 (AIS & DLite data off.)  
20:39:47 Data off.

## AIS Record 8 - Penetration 6, 15,000 ft, 315°.

20:40:17 Data on for penetration 6, 15,000 ft, 315°.  
20:40:30 (AIS & DLite data on. Cloud entry.)  
20:40:33 Data came on at cloud entry.  
20:40:39 (External movie camera triggers automatically - no data-jammed. Cockpit video records a strike.)  
20:40:42 Very close flashes.  
20:40:45 METRO: We show you took a strike, but no triggers.  
20:40:48 We saw a very, very close flash up forward.  
We concur no triggers. Calm and dry but dark at the time.  
20:41:12 Calm, dry, but extremely dark. We see a couple of pixels of red, left and right of course.  
20:41:19 Moderate rain, light turbulence.  
20:41:23 Darkest today.  
20:41:26 Excellent side-to-side lurch, and 1,000 ft/minute rise.  
20:41:31 Another good bounce and cloud exit.  
20:41:35 (Event at cloud exit.)  
20:41:37 Overhead flash in the anvil.  
20:41:48 (AIS & DLite data off.)

## AIS Record 9 - Penetration 7, 15,000 ft, East.

20:43:12 Data systems are on. Heading east. Penetration 7.



20:43:20 (AIS & DLite data on.)  
20:43:23 Cloud entry with event.  
20:43:28 In moderate rain, moderate turbulence, occasionally.  
20:43:37 Green and yellow ahead. Heavy rain, but only light to moderate turbulence.  
20:43:41 Rain falls off to moderate.  
20:44:05 We see two cells ahead, green and yellow. We're heading towards the one on the right, more southern one.  
20:44:13 SPANDAR: 045°, 10 miles, level 5.  
20:44:20 That's the cell over to the left. We're going to the one on the right.  
20:44:26 Calm and dry now.  
20:44:34 SPANDAR: Show level 5 directly ahead, but we are looking below you.  
20:44:42 Light rain to moderate rain.  
20:44:47 Light to moderate turbulence and light to moderate rain.  
20:44:50 Might have had a nearby flash.  
20:44:55 Continuous moderate rain.  
20:44:58 Occasional burst of heavy.  
20:45:01 Light to moderate turbulence.  
20:45:10 Getting extremely bright.  
20:45:15 (Begin left turn.)  
20:45:25 Very light rain.  
20:45:26 Breakout above.  
20:45:31 Breakout on right side.  
20:45:39 Cloud exit. event.  
20:45:41 (Event for cloud exit.)  
20:45:44 Data off.  
20:45:47 (AIS & DLite data off.)

## AIS Record 10 - Penetration 8, 15,000 ft, 320°.

20:46:22 Data on penetration 8, 15,000 ft.  
20:46:40 (AIS & DLite data on.)  
20:46:45 SPANDAR: We show little level 5 in both cells, north and south of you. (Event for cloud entry.)  
20:46:57 1 mile to contour entry and light rain beginning.  
20:47:07 Heading 320°.  
20:47:10 Little bit of frozen water.  
20:47:14 METRO: Starting to show field mill.  
20:47:18 Steady moderate rain and crackle in headset.  
In light turbulence.  
20:47:24 METRO: An E<sub>z</sub> spike at the crackle.  
20:47:27 Steady moderate rain, almost no turbulence.  
20:47:30 Now little bit of light to moderate.  
20:47:32 Cloud exit.  
20:47:34 (Event for cloud exit.)  
20:47:38 (AIS & DLite data off.)  
20:47:39 Data off.)

## AIS Record 11 - Penetration 9, 15,000 ft, 240°.

20:48:25 Data on.  
20:48:30 (AIS &DLite data on.)  
20:48:36 Penetration 9, 240, 15,000 ft.  
20:48:42 Cloud entry.  
20:48:44 Few flashes. (Event for cloud entry.)  
20:48:50 Light rain, light to moderate turbulence.  
20:49:02 Moderate rain, light to moderate turbulence.  
20:49:11 Rain drops to occasional light.  
20:49:14 Nearby flash overhead.  
20:49:21 Moderate rain.  
20:49:23 Couple good bumps. Moderate turbulence.  
20:49:34 (Event for cloud exit.)  
20:50:23 (Event for reentry.)  
20:50:32 (Event for cloud exit.)  
20:51:44 Cloud entry.  
20:51:45 (Event for false reentry.)  
20:51:55 (Radar scan.)  
20:52:25 (Event for reentry.)  
20:52:30 Event for reentry. Still penetration 9.  
20:52:36 METRO: Field mill.  
20:52:38 Crackle in headset with your call.  
20:52:41 Light turbulence and light rain if any at all.  
20:52:47 We are green and yellow ahead about next 8 .....  
20:52:47.6 (DLite LeCroy triggers 1-4. External movie camera triggers automatically no-data-jammed. Cockpit video recorded a strike.  
20:52:48 Direct strike, with triggers.  
20:52:53 (Pitch rate gyro dies.)  
20:52:55 (External movie camera triggers automatically.)  
20:52:56 Nearby flashes.  
20:53:03 Movie camera burst with that?  
20:53:05 METRO: Affirmative.  
20:53:11 (External movie camera triggers automatically.)  
20:53:12 Nearby flashes.  
20:53:15 Light to moderate rain, light turbulence.  
20:53:25 Moderate rain, light to moderate turbulence.  
20:53:30 Heavy rain some turbulence.  
20:53:38 Continuous moderate rain, light to moderate turbulence.  
20:53:42 Getting very bright.  
20:53:44 Nearby flashes.  
20:53:51 METRO: LLP showed a strike right in the airplane at the time you called.  
20:53:56 LLP?  
20:53:58 METRO: Affirmative. It put a mark right on the point the airplane was.  
20:54:02 Coincidence, Roger, coincidence.  
20:54:13 Light to moderate turbulence and getting into rain.  
20:54:20 Getting to moderate rain now.  
20:54:24 Light to moderate turbulence.  
20:54:26 Good bump.  
20:54:27 1,000 ft/minute climb.  
20:54:33 Cloud exit.  
20:54:36 (Event for cloud exit.)  
20:54:42 Data off.

20:54:43 (AIS & DLite data off.)

AIS Record 12 - Penetration 10, 15,000 ft.

20:55:36 Data on.  
20:55:39 Penetration 10, 15000 ft.  
20:55:48 Cloud entry.  
20:55:50 (AIS & DLite data on. Time code stable, cloud entry.)  
20:55:55 Light to moderate rain, light turbulence.  
20:56:00 (Right turn.)  
20:56:04 Moderate rain, moderate turbulence.  
20:56:11 Rain falls off to light, so does turbulence.  
20:56:28 Light rain, light to moderate turbulence.  
20:56:34 Some turbulence but gone to moderate rain.  
20:56:46 Moderate turbulence, moderate rain.  
20:56:48 A little bit of nearby flashes, I think.  
20:56:54 Getting darker. Rain going to occasional heavy.  
20:56:58 Now drops off to nothing. (External movie camera triggers automatically.)  
20:56:59 Very close flashes up forward.  
20:57:03 METRO: Got a camera trigger.  
20:57:06 More nearby flashes overhead. (External movie camera triggers automatically.)  
20:57:09 METRO: Another camera trigger.  
20:57:24 (External movie camera triggers automatically.)  
20:57:25 Very close, heard crackle, but no triggers.  
20:57:40 Flashes ahead.  
20:57:43 Calm and dry, very dark.  
20:58:28 Cloud exit above.  
20:58:57 Moderate rain, moderate turbulence.  
20:59:19 48 miles out.  
20:59:24 Light turbulence, very light rain.  
20:59:40 Moderate rain. Nearby flash.  
20:59:41 (External movie camera triggers automatically.)  
20:59:44 METRO: Camera triggered.  
20:59:49 Continuous moderate rain, light to moderate turbulence.  
20:59:52 Heavy rain at this time.  
20:59:56 Rain drops off to moderate.  
21:00:01 Rain goes to momentary heavy.  
21:00:09 Rain goes to nothing.  
21:00:11 Turbulence goes from light to moderate to nil.  
21:00:29 0° tilt.  
21:00:45 Light rain, moderate turbulence.  
20:01:00 METRO: UHF advises best cell at 225°/40 n. miles from Hopewell.  
21:01:14 SPANDAR: 050° your position, 10 miles, level 5.  
21:01:27 To moderate turbulence, moderate rain.  
21:01:34 Still moderate turbulence, light rain.  
21:01:36 Now we go to moderate, immediately.  
21:01:41 10,000 ft/minute climb.  
21:01:45 Continuous moderate rain.  
21:01:51 2,000 ft/minute climb.

21:02:01 Rain dropping off to light.  
21:02:08 (Left turn.)  
21:02:57 Moderate turbulence, light turbulence.  
21:03:23 (Another left turn.)  
21:03:25 Nearby flash overhead. Burst of light rain.  
21:03:09 Cloud exit.  
21:03:31 (Event for cloud exit.)  
21:03:36 Momentarily cycle data. (AIS & DLite data off.)  
  
AIS Record 13 - Penetration 11, 15,000 ft, South to West.  
  
21:04:22 Data on.  
21:04:30 AIS & DLite data on. Time code stable.)  
21:04:31 Penetration 11, 15,000 ft, heading approximately south.  
21:05:06 Nearby flash.  
21:05:07 SPANDAR: Level 5 due south of you, 5 miles. Also, 240° about 15 miles.  
21:05:23 Very bright thru here. Burst of moderate rain fell off to light.  
21:05:26 In light to moderate turbulence.  
21:05:30 Cloud exit on left.  
21:05:44 In right turn thru west.  
21:06:09 Cloud exit event. (No event. False exit.)  
21:06:40 Occasional burst of light rain and light to moderate turbulence.  
21:07:00 Calm and dry.  
21:07:09 Nearby flash.  
21:07:11 Occasional light rain.  
21:07:14 Moderate turbulence.  
21:07:16 Nearby flash.  
21:07:17 Good side-to-side lurch.  
21:07:19 And moderate rain.  
21:07:27 Continuous moderate rain. Light to moderate turbulence. Getting very dark.  
21:07:37 (Thermal triggers on DLite.)  
21:07:39 METRO: Just saw triggers.  
21:07:41 Roger that.  
21:07:42 I think I saw a flash but it wasn't much.  
21:07:45 Nearby flash. (External movie camera triggers automatically.)  
21:07:48 Moderate turbulence, moderate rain.  
21:07:50 METRO: Got a camera with the nearby flash.  
21:07:59 In continuous moderate rain and light to moderate turbulence.  
21:08:07 Going to heavy rain at this time.  
21:08:11 Drops off to moderate.  
21:08:17 Heavy rain continuous.  
21:08:20 Drops off to light immediately.  
21:08:24 Definitely getting rain attenuation.  
Cell now at 12 miles didn't show up for a number of sweeps.  
21:08:55 (Event for cloud exit.)  
21:08:58 Look at that!  
21:09:00 Multiple cloud to ground strikes over to right. We're going to steer towards the area.  
21:09:09 Nearby flashes on left. (External movie camera triggers automatically.)  
21:09:30 Kind of out in the clear in the haze.

21:09:38 METRO: Camera looked at that.  
21:09:40 Turning left into the cell.  
21:09:48 (Thermal triggers on DLite.)  
21:10:01 (Event for reentry.)  
21:10:04 Event for reentry.  
21:10:12 Nearby flashes up ahead.  
21:10:16 Light rain and light to moderate turbulence.  
21:10:41 Moderate, now heavy, rain.  
21:10:44 Light to moderate turbulence with this.  
21:10:48 Rain drops off to moderate.  
21:10:53 Rain drops off to light.  
21:11:09 Cloud exit.  
21:11:12 (Event for cloud exit.)  
21:11:23 (Thermal triggers on DLite.)  
21:11:28 (AIS & DLite data off.)  
21:11:32 Data off.  
21:11:37 (RHI by SPANDAR.)  
21:11:50 Weapons bay temp off scale on the bottom.  
68 miles out.  
21:12:30 Only calling one confirmed direct strike form the cockpit.  
21:13:35 METRO: Patuxent says the most intense part of the storm is  
Hopewell, 225°/20 n. miles.

AIS Record 14 - Aborted Record - Under the Anvil Metro  
Request.

(AIS & DLite data on. Time code unreadable.)  
(AIS & DLite data off. Time code unreadable.)  
21:13:59 Underneath the anvil.

AIS Record 15 - Penetration 12, 15,000 ft, 060°.

21:15:21 Data systems on. 060°.  
21:15:36 Cloud entry. Penetration 12, 15,000 ft, 060°.  
21:15:37 (Event for cloud entry.)  
21:15:40 (AIS & DLite data on. Time code stable.)  
21:15:47 Calm and dry.  
21:15:56 We see a 2.5 n. miles thick line of green and yellow.  
21:15:59 Light to moderate rain now. Light to moderate turbulence.  
21:16:03 Continuous moderate rain.  
21:16:10 Rain attenuation on the radar.  
21:16:13 No rain at all.  
21:16:16 Light rain.  
21:17:29 (Event for cloud exit.)  
21:17:32 Cloud exit between cells.  
21:17:56 Reentry. (Event for reentry.)  
21:18:00 In moderate rain, light to moderate turbulence.  
21:18:03 1,000 ft/minute rise.  
21:18:07 Light rain.  
21:18:20 Very close flashes with moderate rain, light to moderate  
turbulence. Very, very dark.

(External movie camera triggers automatically.)  
21:18:23 (Thermal triggers on DLite.)  
21:18:26 We have triggers now.  
21:18:32 Conditions unchanged.  
21:18:35 METRO: You got a camera with those triggers.  
21:18:39 More nearby flashes.  
21:18:55 Moderate turbulence.  
21:18:58 Moderate rain, now going to heavy rain.  
21:18:59 (Thermal triggers on DLite.)  
21:19:00 METRO: Got triggers.  
21:19:02 I agree with you.  
21:19:03 Very close flash on left side of aircraft.  
(External movie camera triggers automatically.)  
21:19:06 METRO: Camera with that flash.  
21:19:11 No rain, but still light to moderate turbulence.  
21:19:24 Flash overhead.  
21:19:28 Light rain.  
Light to moderate turbulence.  
21:19:31 Moderate rain.  
21:19:37 Continuous moderate rain.  
Light to moderate turbulence.  
21:19:41 Occasional heavy rain.  
21:19:44 Moderate turbulence.  
21:19:49 Burst of heavy rain.  
21:19:53 Rain drops off to light.  
21:19:57 Now back to moderate, with pretty good moderate bumps.  
21:20:00 (Battery in cockpit video recorder dies.)  
21:20:10 SPANDAR: Level 5, due east your position, 1 mile.  
21:20:26 Moderate turbulence.  
21:20:37 Now in heavy rain.  
21:20:41 Drop back to moderate.  
21:20:44 Continuous moderate turbulence.  
21:20:47 Good wing drop. To light rain.  
21:20:58 Starting a left turn.  
21:21:26 SPANDAR: I show level 5 in cell to north of you, you are headed for.  
21:21:32 We're going to go to the east of that. We see only green and yellow.  
21:21:35 (Radar scan.)  
21:21:49 Once again in the veil between clouds.  
21:22:03 In moderate rain, light to moderate turbulence.  
21:22:14 Continuous moderate rain, turbulence is only light.  
21:22:24 Conditions unchanged.  
21:22:44 Cloud exit. Event.  
21:22:46 (Event for cloud exit.)  
21:22:54 Data off. (AIS & DLite data off.)

AIS Record 16 - Penetration 13, 15,000 ft, 130°.

21:23:49 Data on.  
21:23:51 Cloud entry.  
21:23:58 Lot of good vertical bumps here. 2,000 ft/minute climb.  
21:24:00 (AIS & DLite data on time code stable.)  
21:24:01 Moderate rain.  
21:24:05 Nearby flashes overhead.  
21:24:08 Penetration 13. Heading 130°.  
21:24:24 Coming right to line up with the cells.  
21:24:39 Light rain.  
21:24:44 Moderate rain.  
21:25:05 Flash on the left.  
21:25:08 Occasional light turbulence and occasional light rain.  
21:25:12 SPANDAR: Level 5, 240°, 10 Miles your position.  
21:25:29 Couple close flashes.  
21:25:30 (Radar scan.)  
21:25:39 Very close flashes, and immediately go to moderate rain.  
21:25:58 (External movie camera triggers automatically.)  
21:26:02 Light to moderate turbulence.  
21:26:10 1000 ft/minute climb.  
21:26:21 Continuous moderate rain, light to moderate turbulence. In  
a shallow right turn to line up with the next contour.  
21:26:27 (Thermal triggers on DLite.)  
21:26:28 Moderate turbulence.  
21:26:32 Rain dropped off to light.  
21:26:34 Nearby flash.  
21:26:36 Triggers.  
21:26:44 We're out of tape. 61 minutes (on one of the DLite recorders).  
21:27:01 Moderate turbulence, moderate rain.  
21:27:08 Very close flashes. (External movie camera triggers auto-  
matically.)  
21:27:09 Heavy rain.  
21:27:11 Still moderate turbulence.  
21:27:15 Good side-to-side turbulence.  
21:27:18 Good vertical turbulence.  
21:27:20 1,000 ft/minute up. (End of AIS data tape.)  
21:27:26 Rain dropped to light.  
21:27:28 Still moderate turbulence.  
21:27:32 Rain back to moderate.  
21:27:37 Rain is back to light.  
21:27:40 Excellent turbulence thru there moderate to heavy.  
21:27:43 Nearby flash.  
21:27:44 Nearby flash.  
21:27:46 METRO: We show data off.  
21:27:49 I show red light. We have run out of data on all tape  
recorders.  
21:28:21 Keep cameras on.  
21:28:24 I can do that.  
21:29:18 In moderate rain at 11,000 ft.  
21:29:55 Moderate turbulence.

Moderate rain at 11,000 ft.  
21:30:52 (DLite instrumentation off.)  
21:31:03 Nearby flash on left.  
21:31:20 Passing thru 9,000 ft, moderate rain.  
Turbulence has smoothed out.  
21:33:00 (Film burst of thunderstorm with external movie camera in  
manual mode.  
21:34:17 (Cockpit voice recorder off.)  
21:34:28 (Radar video recorder off.)  
21:38:36 (DLite master power off.)  
(Attempt to bring external movie camera on in manual mode  
for landing. No film remaining.)  
21:44:17 (Landing.)



# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-038 F-106B

Date July 27, 1984

Crew Brown/Fisher

Engine Start 20:01:00

Take-off 20:11:40

Landing 21:44:17

## Lightning Systems:

Dlite 1 Trigger

40ns LeCroy I.1  $\dot{I}_D$  2  $\dot{I}_N$  3  $\dot{I}_T$

5ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

## Non-Lightning Systems:

AIS No vanes. PINOP\*

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

\* Pitch rate

Aft movie camera NG. Jammed

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 2 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Minor damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Blackstone, VA

Pens 13

Strikes 2

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 038

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar OKC-Band Tracking OKGoddard Antennas NUGSFC NU-Too farWFF NU-Too farLaRC NUELF Antenna NULLP PINOP (Dahlgren down)WFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-039, July 28, 1984

Storm Flight/Edenton, NC

Brown/Fisher

GMT

19:36:17 (Engine start.)  
19:38:00 (DLite master power on.)

AIS Record 2 - Takeoff.

19:44:50 (AIS data on.)  
19:45:09 (Takeoff.)  
19:45:53 (AIS data off.)  
19:53:38 (DLite instrumentation on.)

AIS Record 3 - Aborted DLite LeCroy Cals.

19:54:30 (AIS and DLite data on.)  
19:54:35 (AIS and DLite data off.)

AIS Record 4 - DLite Cals.

19:55:00 (AIS and DLite data on.)  
(Two sets of DLite LeCroy Cals.)  
19:57:43 (AIS and DLite data off.)  
19:58:29 (Cockpit voice recorder on.)  
19:58:39 (Radar video recorder on.)  
19:58:47 METRO: Suggest data on.

AIS Record 5 - Penetration #1. 20,000 ft, 200°.

19:59:04 Data is on for penetration #1. 20,000 ft, heading 200°.  
19:59:09 No rain, but light turbulence.  
19:59:10 (AIS and DLite data on. Time code stable.)  
19:59:33 (Clear stormscope.)  
20:00:11 Just showed triggers (thermal upset).  
20:00:20 METRO: Saw no flashes.  
20:00:37 Very close flashes. Light turbulence, no rain. (External camera  
triggers automatically.)  
20:01:04 More triggers (thermal upset).  
20:01:15 Weapons bay temperature is off scales, cold, less than 70°.  
20:01:25 Light turbulence and occasional light rain.  
20:01:32 Getting very bright in the clouds.  
20:01:43 Cloud exit on the right.  
20:01:50 (Event for cloud exit.)  
20:01:55 Event for cloud exit.  
20:02:27 Event for reentry.  
20:02:28 (Event for reentry.)  
20:02:52 LeCroys are tumbling on us.  
20:03:30 (Event for cloud exit.)

20:03:58 (AIS and DLite data off.)

20:03:59 Cycle data off.

20:05:35 LeCroys have been out for sometime now, and are not cycling back on.

20:05:42 METRO: Roger, we see no lights.

20:05:57 (Comments by METRO and flight crew on LeCroy failures and possible solutions.)

20:07:44 METRO: Missile bay temperature?

20:07:47 65°.

20:08:07 METRO: What kind of rain have you been in lately?

20:08:13 Gone from no rain to very light rain now.

AIS Record 6 - Penetration 2 and 3.

20:08:16 Data systems coming on.

20:08:21 Four green lights. No LeCroys.

20:08:24 Nearbys. (External camera triggers automatically.)

20:08:25 Very close flashes.

20:08:29 Tape recorders just kicked off line. (DLite tape recorders lights go out.)

20:08:40 (AIS and DLite data on. Time code stable.)

20:08:43 I think we've lost all DLite. Have to get outside and recycle.

20:08:51 Why not recycle in here, why wait?

20:08:55 Got recorders back. (DLite tape recorder lights on after cycling DLite tape recorders switch.)

20:09:11 Light rain, intermittently.

20:09:27 METRO: Heavy rain is down around 4,000 ft.

20:09:44 DLite is finally stabilized.

20:09:48 Partial breakout right.

20:10:48 LeCroys dumped again.

20:11:52 (External camera triggers automatically.)

20:11:53 Nearbys.

20:11:55 Event for new penetration. (Event to end penetration 2 and begin penetration 3.)

20:12:05 Penetration #3. 20,000 ft, starting at 060°. Now in right turn.

20:12:28 Light turbulence and light rain.

20:12:53 Breakout above.

20:13:02 Cloud exit.

20:13:03 (Event for cloud exit.)

20:13:06 (AIS and DLite data off.)

20:13:09 Data off.

20:13:22 (METRO and flight crew discuss LeCroy symptoms/thermal upset.)

## AIS Record 7 - Penetration #4.

20:13:46 Data on.

20:13:50 (AIS and DLite data on. Time code stable.)

20:13:51 Penetration #4. 20,000 ft.

20:14:16 Dry, but in continuous light turbulence as we make a turn around to the left.

20:14:27 METRO: Go up to 30,000 ft, and cold-soak them. See if it cures it.  
20:16:14 Nearby flash.  
20:17:55 (Event for cloud exit at 26,000 ft.)  
20:17:56 Cloud exit.  
20:18:06 (AIS and DLite data off.)  
  
20:18:07 Data off.  
20:18:45 Out of 30 for 31. (FL300 - FL310).  
20:19:13 -5° (radar tilt angle)  
20:19:51 METRO: Have you been in any precipitation in last 5 minutes?  
20:19:55 METRO: Very little.  
20:20:04 LeCroys are staying a little longer.  
20:20:19 (METRO and flight crew discuss LeCroys and airborne radar returns.)  
20:20:55 METRO: Unless something drastic happens, or you can suggest something different, I think we ought to come home and trouble shoot our recorders.  
20:21:04 We concur. There is nothing at this altitude to penetrate.  
20:21:09 METRO: Even if it is, you probably wouldn't get it. Why don't you RTB at this time?  
20:23:41 Metro, what are field mills showing you at this time?  
20:23:45 METRO: We are seeing some moderate activity. Do you see any conditions?  
20:23:49 We are getting occasional light rain and occasional light turbulence. We are in clouds at this time. The LeCroys have stabled up-all 3 are on.  
20:24:29 Just had total cloud exit. We are underneath overhanging shelf.  
20:25:58 (Cockpit voice recorder off.)  
20:26:12 (Radar video recorder off.)  
20:32:39 (DLite instrumentation off.)  
20:32:53 (DLite master power off.)  
  
AIS Record 8 - Landing.  
  
20:39:00 (AIS data on.)  
20:40:19 (Landing.)  
20:41:33 (AIS data off.)  
  
AIS Record 9 - Chocks  
  
20:45:20 (AIS data on.)  
20:46:13 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-039 F-106B

Date July 28, 1984

Crew Brown/Fisher

Engine Start 19:36:17

Take-off 19:45:09

Landing 20:40:19

Lightning Systems:

Dlite 0 Triggers\*\*

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

5ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1 I=0 2  $\dot{D}_F=0$

\*\* multiple spurious triggers.

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 0 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 0 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Edenton, NC

Pens 4

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 039

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_

Videotape \_\_\_\_\_ NG \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ NG \_\_\_\_\_

LDAR \_\_\_\_\_ NG \_\_\_\_\_

UHF Radar \_\_\_\_\_ NG \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ NU \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ NU \_\_\_\_\_

LaRC \_\_\_\_\_ NU \_\_\_\_\_

ELF Antenna \_\_\_\_\_ NI \_\_\_\_\_

LLP PINOP (Dahlgren down.)

WFF Plots \_\_\_\_\_ NG \_\_\_\_\_

LaRC Plots \_\_\_\_\_ NG \_\_\_\_\_

WFF Tape \_\_\_\_\_ NG \_\_\_\_\_

Debrief Notes for Flight 84-040, August 1, 1984.

Storm Flight/Matthews, VA

Neely/Winebarger

GMT

AIS Record 1 - Video check.

20:16:30 Engine start.

AIS Record 2 - Takeoff.

20:33:10 (AIS data on.)

20:33:37 (Liftoff.)

20:42:27 (AIS data off.)

AIS Record 3 - DLite Cals and Pen #1.

20:44:20 (Event - storm entry.)

20:44:28 In the storm.

20:44:34 Pretty heavy precip.

20:44:38 Very smooth.

20:44:43 Real smooth.

20:44:37 Heavy precip now. Still a smooth ride. Slight bump there.

20:44:54 Momentary breakout on the left.

20:45:07 Back in heavy rain. A little turbulence.

20:45:15 A smooth ride. Take this all day. Nothing to this thunderstorm.

20:45:20 (Metro, needs 4 minutes out of storm.)

20:45:23 (Event - storm exit.)

20:45:33 (Data off.)

20:46:45 Not a very big storm.

20:47:08 78° weapons bay.

20:48:10 (Tops about 25,000 ft.)

AIS Record 4 - Pen #2.

20:51:20 (Data on.)

20:51:24 Data is on for penetration 2.

20:51:31 Cloud entry. Heading 070°, altitude 15,000.

20:51:38 Light precip.

Now moderate.

20:51:54 We're breaking in and out of it.

20:52:11 This thing has no structure. It is just a collection of clouds.

20:52:21 In bright sunshine now.

20:52:25 Now heavy precip.

20:52:50 (Event - storm exit.)



20:53:26 (Data off.)  
20:54:58 Crummy storm.  
20:56:05 Little old cell is so small it is hard to hit going 070°.   
20:56:25 Looking at this thing outside. It doesn't look like  
a thunderstorm.  
20:56:32 METRO: Don't look like one from this side either.  
20:58:24 METRO: If you don't get a strike this penetration I  
suggest you RTB. The tops are very low. Well below  
30,000.

AIS Record 5 - Pen #3 and DLite Cals.  
20:59:20 (Data on.)  
20:59:26 Back in clouds for penetration 3. Heading 250°,  
altitude 15,000.  
20:59:34 (Event - storm exit.)  
21:01:15 I'll do a DLite cal now.  
21:02:26 (Data off.)

AIS Record 6 - Landing.  
21:12:40 (AIS data on.)  
21:15:00 (Touchdown.)  
21:15:45 (AIS data off.)

AIS Record 7 - Chocks.

21:18:30 (AIS data on.)  
21:18:48 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 040 F-106B

Engine Start 20 : 16 : 30

Date August 1, 1984

Take-off 20 : 33 : 37

Crew Neely/Winebarger

Landing 21 : 15 : 00

Lightning Systems:

Non-Lightning Systems:

Dlite 0 Triggers

AIS No Vanes.

40ns LeCroy I.1  $\dot{D}_F$  2  $I_N$  3  $I_T$

INS OK

10ns LeCroy II.1  $\dot{D}_T$  2  $I$  3  $\dot{B}_L$

Telemetry:Top OK

LeCroy III.1 INOP 2 INOP 3 INOP

Bottom OK

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Airborne Radar: Fwd OK

Digital Peak Counter 1  $\dot{I}=0$  2  $\dot{D}_F=0$

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Aft movie camera 0 Strikes

Kavouris Radar

Cockpit cameras

Receiver OK

Stereo Fwd NI

Hass aft NI

Aft video 0 Strikes.

Field Mills (4) OK

Region Mathews, VA

X-Ray TBD

Los Top TBD Aft TBD

Pens 3

Fin Cap Type KT/EP

Strikes 0

Passive protection

Nearbys 0

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 040

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape NU-Erased after flightSatellite Pictures INOPWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NUELF Antenna NILLP INOP (Dahlgren down)WFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-041, August 2, 1984

Storm Flight/Rehoboth Beach, DE

Neely/Fisher

GMT

20:14:30 (Engine start.)  
21:16:15 (DLite master power on.)

AIS record 2 - Takeoff.

21:45:50 (AIS data on.)  
21:27:34 (Takeoff.)  
21:28:17 (AIS data off.)

21:41:31 (DLite instrumentation on.)  
(DLite prepenetration calcs.)  
21:43:00 (Voice recorder on.)  
21:43:09 (Radar/O-5 video recorder on.)  
21:44:21 Weapons bay temperature is 75°. Dropping.  
21:44:38 SPANDAR: Level 4 is maximum in storm we're working.

AIS record 3 - Pen #1.

21:45:50 (AIS & DLite data on.) This is penetration #1. 030°, 15,000 ft  
still in the clear.  
21:45:57 Data systems up. Camera on. In automatic mode today.  
21:46:09 Event for cloud entry. (Event.)  
21:46:11 We're a little to the right of the worst contour.  
21:46:18 Light turbulence, light rain.  
21:46:38 Nearby flashes. Overhead.  
21:46:50 Conditions unchanged.  
21:46:55 Breakout level.  
21:47:03 (AIS & DLite data off.)  
  
21:47:04 Data off.  
21:48:01 SPANDAR: Small area of level 5. Goes and comes due west your  
position, 5 miles.  
21:50:10 SPANDAR: 225° your present position, 7 miles, we show small  
area level 6.  
21:50:29 SPANDAR: It has dropped to level 5. About 240° your position,  
7 mi.

AIS record 4 - Pen #2.

21:51:20 Data systems on.  
21:51:25 Penetration #2. 210°, 15,000 ft.  
21:51:35 (Event for cloud entry.)  
21:51:38 Cloud entry.  
(AIS & DLite data on. Time code stable.)  
21:51:40 Light turbulence, very light rain.

(AIS & DLite data on. Time code stable.)  
21:51:44 See only green and yellow ahead about time.  
21:51:53 Nearby flashes.  
21:52:01 Moderate rain, very light turbulence.  
21:52:15 Still moderate rain.  
21:52:27 Cloud exit, event. (Event.)  
21:52:34 (AIS & DLite data off.)  
  
21:52:35 Data off.  
21:54:47 Weapons bay temperature is 73°, and still going down.  
21:55:23 METRO: Tops are 28K.  
21:56:16 SPANDAR: 015°, 10 miles, level 5.  
  
AIS record 5 - Pen #3.  
  
21:56:35 Data systems are on.  
21:56:43 Penetration #3, 15,000 ft, 030°.  
21:56:50 (AIS & DLite data on. Time code stable.)  
21:56:51 Green and yellow ahead. About 5 miles worth.  
21:56:58 (Event for cloud entry.)  
21:57:00 Cloud entry, event.  
21:57:03 Nearby flashes, moderate rains.  
21:57:04 Light turbulence.  
21:57:07 METRO: See field mills.  
21:57:08 Heavy rain, light turbulence.  
21:57:16 Solid-sounding rain.  
21:57:18 Nearby flash.  
21:57:26 Very heavy rain.  
21:57:28 Light turbulence.  
21:57:32 Rain falls off to moderate.  
21:57:37 Cloud exit.  
21:57:39 (Event for cloud exit.)  
21:57:45 Data off.  
21:57:46 (AIS & DLite data off.)  
21:58:05 Crew saw cloud to ground-to-water, (070° from aircraft)  
21:58:32 (METRO: Suggests going to more distant storm.)  
22:00:35 Coming around to right to 030° to penetrate the second line of cells.  
22:01:08 Weapons bay temp. is 70°.

## AIS record 6 - Pen #4.

22:01:50 (AIS & DLite data on.) Data on for penetration #4, 030°, 15,000 ft.  
22:02:05 Cloud entry with event. (Event.)  
22:02:12 Dry and calm.  
22:02:19 Light rain now.  
22:02:21 Light turbulence.  
22:02:54 SPANDAR: 090° your position, 5 mi., level 5.  
22:03:07 SPANDAR: There is also one 270° your position, 5 mi.  
22:03:20 METRO: (SPANDAR, UHF & field mills suggest returning to first storm.)  
22:03:38 Keeping data on as we turn around through the clouds. Got some pretty good vertical development.

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 041 F-106B

Date August 2, 1984

Crew Neely/Fisher

Engine Start 20 : 14 : 30

Take-off 21 : 27 : 34

Landing 22 : 55 : 06

## Lightning Systems:

Dlite 0 Triggers

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=0$  2  $\dot{D}_F=0$

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 0 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 0 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Rehoboth Beach,

DE

Pens 14

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 041

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures INOPWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR OKUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NUELF Antenna NILLP PINOP (Dahlgren down)WFF Plots OKLaRC Plots OKWFF Tape OK

22:04:32 SPANDAR: 225°, 5 miles: level 5.  
22:04:48 (AIS & DLite data off.)

22:04:50 Data off for a moment.  
22:04:58 126 n.mi. from home.

AIS record 7 - Pen #5.

22:05:04 Data is on.  
22:05:10 (AIS & DLite data on. Time code stable.)  
22:05:11 Cloud entry, event. (Event.)  
22:05:18 Penetration #5, 15,000 ft, 210°, light turbulence, moderate rain.

22:05:33 A distant flash overhead.  
22:05:42 Continuous moderate rain and occasional light turbulence.  
22:06:05 Cloud exit. (Event.)  
22:06:35 (AIS & DLite data off.)

22:06:39 Data off in the clear.  
22:06:47 SPANDAR: See little level 5, 220°, 7 miles.  
22:06:54 SPANDAR: Highest reflectivity is green and yellow  
22:07:02 And the storms behind us are beginning to develop anvils.

AIS record 8 - Pen #6.

22:07:39 Data on.  
22:07:44 Penetration 6, 15,000 ft, 210°.  
22:07:50 (AIS & DLite data on. Time code stable.)  
22:07:55 Cloud entry, event. (Event.)  
22:08:00 Moderate rain.  
22:08:01 Light to moderate turbulence.  
22:08:05 Heavy rain.  
22:08:09 (Rain) Falls off to moderate.  
22:08:11 That was a burst (of rain).  
22:08:13 Like flying into a wall.  
22:08:18 In moderate rain.  
22:08:20 Light to moderate turbulence.  
22:08:21 Now falling off to light turbulence.  
22:08:25 Rain off to light.  
22:08:31 Breakout right.  
22:08:33 Nearby flash on left.  
22:08:50 Cloud exit, event. (Event.)  
22:08:59 Data off. (AIS & DLite data off.)

22:09:56 Stormscope acting strange. Continuous points coming on and off the screen at 330° and 120° on its markings.  
(Discussion about anvil - in storms and cloud tops. SPANDAR sees tops in 30's in northern cells, only 20's in southern cells.)

22:12:09 Radar is acting funny. Showing all green & yellow on the left side.

22:12:54 The highest rain rates are in the southern cells.  
22:13:15 100 miles out.



## AIS record 9 - Pen #7.

22:13:50 Data on.  
22:13:54 Penetration #7. 15,000 ft, 030°.  
22:13:59 In blow-off from first storm.  
22:14:00 (AIS & DLite data on. Time code stable.)  
22:14:14 Weapons bay 65°.  
22:14:16 (Event for cloud entry.)  
22:14:17 Cloud entry with event.  
22:14:20 Light turbulence, moderate rain.  
22:14:26 Weapons bay off scale, cold.  
22:14:35 (External camera triggered. No lightning seen.)  
22:14:36 Very close flashes.  
22:14:41 METRO: Camera triggered.  
22:14:46 Moderate rain, light to moderate turbulence.  
22:14:51 (Event for cloud exit.)  
22:14:53 Cloud exit on first line of cells.  
22:15:22 (AIS & DLite data off.)  
  
22:15:23 Data off.

## AIS record 10 - Pen #8.

22:15:47 Data on for penetration #8, 15,000 ft, 030°.  
22:15:50 (AIS & DLite data on. Time code stable.)  
22:16:09 Cloud entry, event. (Event.)  
22:16:15 Light rain, light turbulence.  
22:16:26 Light to moderate turbulence, moderate rain.  
22:16:48 Conditions unchanged.  
22:17:20 SPANDAR: 315°.  
22:17:27 Cloud exit, event. (Event.)  
22:17:34 (AIS & DLite data off.)  
  
22:17:53 METRO: Do a right 18° down the line.

## AIS record 11 - Pen #9.

22:19:52 Data on.  
22:20:00 AIS & DLite data on. Time code stable. (Cloud entry.)  
Penetration #9, 15,000 ft, 210°.  
22:20:15 METRO: Field mills better, anyway, over there.  
22:20:17 Moderate rain.  
22:20:20 Light to moderate turbulence, mostly light.  
22:20:26 Rain falls off to light.  
22:20:50 Cloud exit, event. (Event.)  
22:21:14 Data off momentarily. (AIS & DLite data off.)

## AIS record 12 - Pens #10 &amp; 11.

22:22:15 Data on.  
22:22:20 (AIS & DLite data on. Time code stable.)  
22:22:23 Penetration 10, 15,000 ft, 210°.  
22:22:31 Cloud entry with an event. (Event.)  
22:22:35 Light to moderate rain.

22:22:36 Light to moderate turbulence.  
22:22:55 Moderate rain.  
22:22:56 Light to moderate turbulence.  
22:23:03 1000 ft/min updraft.  
22:23:11 METRO: Field mills are no good.  
22:23:15 Light rain now.  
22:23:17 Almost no turbulence.  
22:23:32 METRO: Go back to the east end of the north line.  
22:23:44 Occasional breakout.  
22:24:37 Nearby flash, overhead.  
22:24:44 Event. (Event to end Pen #10, begin Pen #11.)  
22:25:00 Penetration #11, 15,000 ft, heading due North.  
22:25:17 Storms are falling apart.  
22:25:29 Relatively smooth ride and no rain.  
22:25:37 I don't believe that the digital elapsed time counter on the  
DLite is working correctly.  
22:26:06 Range 111 (n.mi.).  
22:26:10 (Event for cloud exit.)  
22:26:15 (AIS & DLite data off.)  
  
22:26:24 Cloud exit.  
22:26:26 Data off. Between the two lines.  
  
AIS record 13 - Pen #12.  
  
22:26:59 Data on.  
22:27:04 Penetration #12, 15,000 ft, 020°.  
22:27:10 (AIS & DLite data on. Time code stable.)  
22:27:21 Cloud entry event. (Event.)  
22:27:29 Moderate rain.  
22:27:30 Light turbulence.  
22:28:10 Cloud exit left, but not ahead.  
22:28:19 -2° tilt.  
22:28:39 Light rain, and very light turbulence.  
22:28:48 Cloud exit. Event.  
22:28:50 (Event for cloud exit.)  
22:28:58 (AIS & DLite data off.)  
  
AIS record 14 - Pen #13.  
  
22:29:48 Data on.  
22:29:54 Moderate rain.  
22:29:55 Light to moderate turbulence.  
22:29:56 Penetration #13, 15,000 ft. Turning around now to South.  
22:30:10 (AIS & DLite data on. Time code stable. Cloud entry.)  
22:30:16 Rain is off to light, turbulence is none.  
22:30:30 Light turbulence, light rain.  
22:30:38 Heading 120°.  
22:30:45 We're looking out that way (out to sea), and all I see is some  
green showers. I don't see any yellow at all.  
22:30:55 METRO: May as well come on home.  
22:31:21 Moderate rain, light turbulence.  
22:31:49 Cloud exit, event. (Event.)  
22:31:56 (AIS & DLite data off.)

22:32:49 We see 3 small cells, green & yellow, starting about 5 miles ahead, extending out to about 12 miles. On a heading of 240°.

AIS record 15 - Pen #14.

22:33:47 Cloud entry, event. (Event.)  
22:33:53 Penetration 14, 15,000 ft, 240°.  
22:33:57 Moderate rain, light turbulence.  
22:34:00 (AIS & DLite data on. Time code stable.)  
22:34:15 Moderate rain and light turbulence.  
22:34:38 That's strange. I had a beautiful return on the scope, and then in one sweep it was gone.  
22:34:41 Cloud exit. (Event.)  
22:34:52 We're going to start home.  
22:34:59 (AIS & DLite data off.)  
22:36:20 (Voice recorder off.)  
22:36:29 (Radar/0-5 video recorder off.)

AIS record 16 - DLite Cals.

22:37:00 (AIS & DLite data on.). (Three sets of cals. DLite LeCroy Crate #1 will not trigger.)  
22:39:24 (AIS & DLite data off.)

AIS record 17 - DLite Cals.

22:40:00 (AIS & DLite data on.)  
(One set of cals. DLite LeCroy Crate #1 will not trigger.)  
22:40:30 (AIS & DLite data off.)  
22:40:50 (DLite instrumentation off.)

AIS record 18 - Landing.

22:54:30 (AIS data on.)  
22:55:06 (Landing.)  
22:56:05 (AIS data off.)  
22:57:19 (DLite master power off.)

AIS record 19 - Chocks.

22:58:20 (AIS data on.)  
22:59:10 (AIS data off.)

Debrief Notes for Flight 82-042, August 3, 1984

Storm Flight/Belvior, VA

Brown/Winebarger

GMT

AIS Record 1 - Video Check.

18:28:04 Engine start.

AIS Record 2

18:40:50 (AIS data on.)

18:41:33 (Liftoff.)

18:42:13 (AIS data off.)

18:58:45 Weapons bay temperature 75°.

18:59:09 SPANDAR: Small area level 5, 315°, 5 miles your position.

AIS Record 3 - Penetration 1.

18:59:10 (Data on.)

18:59:23 Data is on for penetration 1, 15,000 ft, left turn.

18:59:33 In the cloud.

18:59:34 Precip.

18:59:48 Heavy rain.

18:59:49 Moderate turbulence.

19:00:01 Very heavy precip.

19:00:17 0° tilt.

19:00:28 (Scan radar.)

19:01:00 Pixel of red, I'll let that pass to the left side of us.

19:01:21 Heavy rain again.

19:01:41 Real bright now.

19:02:07 Breakout.

19:02:13 (Data off.)

AIS Record 4 - Penetration 2.

19:03:37 (Event-storm entry.) Cloud entry for penetration 2, altitude 15,000, heading due east.

19:03:40 (Data on.)

19:03:52 Spandar: Show level 5 within a mile of you, north, also another level 5, 045°, 10 miles.

19:04:04 In heavy rain now.

19:04:40 METRO: Echo.

19:05:17 In heavy rain again.

10:05:28 METRO: Very flat field mills

19:05:48 METRO: Echo by.

19:06:16 (Event - storm exit.)  
19:06:18 Breaking out.  
19:06:21 (Data off.)  
19:06:26 Not much electrical activity. Do you have anything better?  
19:06:54 METRO: UHF advises saw 2-3 echo's in that cell let's hang in there a little longer before you go roaming.

## AIS Record 5 - Penetration 3.

19:08:00 (Data on.)  
19:08:00 Data is on for penetration 3, altitude 14,700, heading 300°.  
19:08:23 Had a pretty smooth ride for most part. No big updrafts or downdrafts.  
19:08:36 (Event - storm entry.) In the storm.  
19:08:51 Heavy precip now.  
19:09:02 METRO: Echo.  
19:09:10 Light to moderate turbulence.  
19:09:12 METRO: Echo behind.  
19:09:29 In moderate precip now.  
19:10:39 Light turbulence.  
19:10:40 Little more precip again.  
19:10:46 Heavy precip.  
19:10:58 Getting bright.  
19:11:13 (Event - storm exit.)  
19:11:16 (Data off.)  
19:11:22 Out in clear.  
0° tilt. (Radar scan.)  
19:14:30 (Scan radar.)  
19:14:38 Why don't you send us a new Kavouris  
19:14:42 METRO: Good idea.

## AIS Record 6 - Penetration 4.

19:16:50 (Data on.)  
19:17:02 Data is on for penetration 4. In kinda light blow off from that.  
19:17:12 Starting to enter now.  
19:17:20 We're at 15,000 ft, coming around about 300°.  
19:17:32 Getting some light turbulence.  
19:17:37 Precip now.  
19:17:53 Heavy precip.  
19:18:04 Quite a bit of an updraft.  
19:19:14 Making a turn in the clouds. Leaving data on.  
19:19:48 Picking up another cell.  
19:19:49 Heavy rain now.  
19:20:08 Heading due west.  
19:20:12 METRO: We would like you to get on a heading of 70° thru your present position.  
19:20:27 Moderate turbulence occasionally.

19:20:29 Few little bumps there.  
19:20:37 (Event - storm exit.)  
19:20:38 We broke out.  
19:20:40 (Data off.)  
19:20:44 Radome looks ok.

## AIS Record 7 - Penetration 5.

19:21:35 Data is on for penetration 5.  
Altitude 14,800.  
19:21:40 (Data on.)  
19:21:42 (Event - storm entry.)  
19:21:44 Now in heavy precipitation.  
19:22:25 Heading 070° with another big cell ahead of us.  
19:22:50 Heavy precipitation.  
19:22:56 Moderate turbulence.  
19:23:01 Good turbulence.  
19:23:15 METRO: If you don't get struck in this line go back to the original line.  
19:23:34 We've left the heavy rain.  
19:24:22 (Event - storm exit.)  
19:24:30 (Data off.)

## AIS Record 8 - Penetration 6.

19:28:10 (Data on.)  
19:28:13 Data is on for penetration 6, altitude 15,000, will be coming left to east heading.  
19:29:20 (Storm entry.)  
19:28:25 In heavy precipitation.  
19:28:41 Good bounce there.  
19:28:44 (Exit - first cell.)  
19:29:26 SPANDAR: 050°, 12 miles, level 5.  
19:29:30 (Enter 2nd cell.)  
19:30:03 Nearby flash - or a distant flash, I guess.  
19:30:58 In next cell. Heavy precipitation now.  
19:31:05 Flashes.  
19:31:53 METRO: Your last minute of your penetration looked very interesting.  
19:32:03 That was first flash I had seen. Phill saw one a little bit earlier.  
19:32:06 (Event - storm exit.)  
19:32:10 (Data off.)

## AIS Record 9 - Penetration 7.

19:33:44 We're back in the cloud. I brought data on but we've still got a ways to go to the contour.  
19:33:50 (Data on.)

19:34:07 This is penetration 7, 14,700, heading 260°.  
19:34:16 Distant flash.  
19:34:24 SPANDAR: Due east your position, 7 miles, level 5.  
19:34:31 Some light turbulence now.  
19:34:36 METRO: Some moderate activity in field mills.  
19:34:44 Starting to pick up a little precip now.  
19:34:54 Heavy precip.  
19:35:06 Real heavy precip.  
19:35:18 Some updrafts.  
19:36:58 (Event - storm exit.)  
19:37:00 (Data off.)

## AIS Record 10 - Penetration 8.

19:39:30 (Data on.)  
19:39:39 Data is on for penetration 8, heading 100°, altitude 15,000.  
19:39:50 In the storm.  
19:39:51 Precip.  
19:41:05 Heavy precip.  
19:41:13 Flashes.  
19:41:45 (Event - storm exit.)  
19:41:47 (Data off.)

## AIS Record 11 - Penetration 9.

19:43:30 (Data on and storm entry.)  
19:43:32 Data on for penetration 9, heading 280°, altitude 15,000.  
19:43:48 Light precip.  
19:43:50 Light turbulence.  
19:43:55 Lots of flashes there.  
19:44:03 Heavy precip, good bounce.  
19:45:36 (Event - storm exit.)  
19:45:40 (Data off.)  
19:46:10 We're in the cloud. See any field mills to bring data back on?  
19:46:42 Bring it on.

## AIS Record 12 - Penetration 10.

19:46:58 Penetration 10, altitude 15,000, heading 110°.  
19:47:00 (Data on.)  
19:47:20 Starting turn to left.  
19:47:58 Heavy precip.  
19:48:02 Good bounces there.  
19:48:08 Flashes..  
19:48:39 (Event - storm exit.)  
19:48:45 (Data off.)  
19:49:26 Sure gives stormscope activity.  
19:49:42 METRO: Suggest you return to Langley and work cell about 15 miles west of Portsmouth,

## AIS Record 13 - Penetration 11.

20:06:39 Data is on for penetration 11. Altitude 16,000, heading 200°.  
20:06:40 (Data on.)  
20:06:54 (Event-storm entry.) Storm entry, heavy rain immediately.  
20:07:15 Updraft.  
20:06:23 Few good bumps there - real heavy rain continuously.  
20:07:33 (Event - storm exit.)  
20:07:34 And we're out.  
20:07:37 (Data off.)

## AIS Record 14 - Penetration 12.

20:09:20 (Data on and event - storm entry.)  
20:09:23 In storm heading 10°, altitude 158.  
20:09:43 Some good bounces.  
20:10:07 (Event - storm exit.)  
20:10:10 (Data off.)

## AIS Record 15 - DLite Cals.

20:13:00 (Data on.)  
20:14:24 (Data off.)  
20:19:20 (Touchdown.)

## AIS Record 16 - Chocks.

20:22:50 (AIS data on.)  
20:23:32 (AIS data off.)



STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 042 F-106B

Date August 3, 1984

Crew Brown/Winebarger

Engine Start 18 : 28 : 04

Take-off 18 : 41 : 33

Landing 20 : 19 : 20

Lightning Systems:

Dlite 0 Triggers

40ns LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=0$  2  $\dot{D}_F=0$

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 0 Strikes

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 0 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Belvoir, VA

Pens 12

Strikes 0

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 042

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures INOPWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR OKUHF Radar OKC-Band Tracking OKGoddard Antennas NUGSFC NUWFF NU - Too far.LaRC NUELF Antenna NILLP PINOP (Dahlgren down)WFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-043, August 8, 1984

Storm Flight/Coinjock, NC

Brown/Fisher

GMT

(Start recorder for cockpit video camera.)  
20:10:34 (Engine start.)  
20:12:53 (DLite master power on.)

AIS record 1 - Takeoff.

20:18:50 (AIS data on. Cockpit video camera on.)  
20:19:19 (Takeoff.)  
20:20:03 (AIS data off. Cockpit video camera off.)  
  
20:29:38 (Cockpit voice recorder on.)  
20:29:49 (Radar video recorder on.)  
20:31:10 (DLite instrumentation on.)  
20:32:00 (DLite LeCroy cal with no tape.)  
20:33:00 (DLite LeCroy cal with no tape.)  
20:34:10 SPANDAR: 170°, 10 miles your position, level 5.

AIS record 2 - Penetration #1, 19,000 ft., 160°.

20:34:30 (AIS and DLite data on. Cockpit video camera on.)  
20:34:31 Data systems on.  
20:34:38 One second burst on the camera. (External movie camera manually  
actuated for one second.)  
20:34:48 Penetration #1, 19,000 ft., 160°.  
20:35:00 Nothing on Stormscope, but I don't trust it.  
20:35:07 Cloud entry with event. (Event.)  
20:35:10 Rain.  
20:35:12 Light turbulence, light rain.  
20:35:15 I'd call this more than light.  
20:35:16 Now moderate rain, light turbulence.  
20:35:38 Cloud exit, event. (Event.)  
20:35:47 Data off.  
20:35:48 METRO: Great field mill activity.  
20:35:49 (AIS and DLite data off. Cockpit video camera off.)

(All four LeCroy trigger lights extinguished and both DLite  
tape recorder lights remain illuminated.)

AIS record 3 - Penetration #2, 19,000 ft., 315°.

20:37:56 Penetration #2, 315°, 19,000 ft.  
20:38:00 (AIS and DLite data on. Cloud entry. Cockpit video camera on.)  
20:38:04 Light turbulence and occasional light rain.  
20:38:10 I'd call that at least moderate rain.  
20:38:13 In moderate rain now.

20:38:16 Still light turbulence.  
20:38:25 Had no triggers. (No trigger lights.)  
20:38:26 Cloud exit, event. (Event.)  
20:38:33 (AIS and DLite data off. Cockpit video camera off.)  
  
(More comments concerning status of DLite system.)  
20:39:18 Instrumentation power off. (DLite instrumentation off.)  
20:39:40 (Tape recorder lights are still on, but counter is not running.)  
20:39:52 Instrumentation power on. (DLite instrumentation on.)  
  
AIS record 4 - Penetration #3, 19,000 ft., 120°.  
  
20:40:35 Data tape on. 120°. (Cockpit video camera on.)  
20:40:41 Penetration #3.  
20:40:47 Cloud entry, event.  
20:40:48 (Event for cloud entry.)  
20:40:50 That's at least moderate rain. (AIS and DLite data on.  
Time code stable.)  
20:40:54 Light turbulence.  
20:41:05 Rain falls off to light, still light turbulence.  
20:41:55 Out now. (Event for cloud exit.)  
20:41:57 (AIS and DLite data off. Cockpit video camera off.)  
  
20:41:59 Data off.  
20:42:19 Instrumentation power off. (DLite instrumentation off.)  
20:42:23 DLite master power off.  
20:42:34 DLite master power on. (Radar video recorder drops off line.)  
20:43:00 Instrumentation power up. (DLite instrumentation on.)  
METRO: (Request DLite CAL)  
20:43:52 0° tilt.  
20:44:04 (DLite cal without tape.)  
20:44:14 Weapons bay is nice and cold.  
20:44:21 Nice-looking cells.  
20:44:36 SPANDAR: We show 2 areas of level 5, 1 due east, about 15 miles;  
another 060°, 10 miles.  
20:44:53 +2°.  
20:44:59 -2°.  
20:45:04 METRO: Everything looks normal on DLite down here.  
20:45:05 We concur.  
20:45:44 We see a line of green and yellow cells ahead perpendicular  
to us. We're going to make a right turn to 120° for penetration.  
  
AIS record 5 - Penetration #4, 19,000 ft., 120°.  
  
20:45:56 Data is on. (Cockpit video camera on.)  
20:46:04 SPANDAR: We show level 5 dispersed pretty much down that  
line, running southeast from you for the next 15 miles.  
20:46:08 (Event for cloud entry.)  
20:46:10 (AIS and DLite data on. Time code stable.)  
20:46:13 Cloud entry.  
20:46:14 Moderate rain, light to moderate turbulence.  
20:46:23 DLite looks good.  
20:46:38 Moderate turbulence, moderate rain.  
20:46:43 Green and yellow (Contours on radar).

20:46:52 1000 ft./min. downdraft.  
20:47:04 Heavy rain, moderate turbulence.  
20:47:25 Break out on left.  
20:47:32 In the clear between 2 very distinct cells.  
20:47:41 In second turret.  
20:47:46 Moderate to heavy rain.  
20:47:47 Call it heavy rain.  
20:47:52 Very heavy rain.  
20:47:54 Light to moderate turbulence.  
20:48:01 Rain falls off to light, as does the turbulence.  
20:48:07 Cloud exit left.  
20:48:13 Breakout above.  
20:48:22 Cloud exit, event.  
20:48:23 (Event for cloud exit.)  
20:48:28 Data off. (AIS and DLite data off. Cockpit video camera off.)

20:48:39 End penetration #4.

AIS record 6 - Penetration #5, 19,000 ft., 330°.

20:49:10 Data on. (Cockpit video camera on.)  
20:49:16 Penetration #5, 19,000 ft.  
20:49:20 (AIS and DLite data on. Time code stable.)  
20:49:27 METRO: Norm requests you go up to 23,000.  
20:50:01 Cloud entry- event. (Event.)  
20:50:07 Light turbulence, light rain.  
20:50:10 315°, 10 miles, level 5.  
20:50:26 Good strike! (DLite LeCroy triggers 1,2,and 4. Cockpit video camera records a strike.)  
20:50:28 Direct strike to nose boom. 3 triggers.  
20:50:33 Light rain, light turbulence at the time.  
20:50:35 Now in moderate rain and light turbulence.  
20:50:48 Noise was only moderate.  
20:50:52 Breakout above.  
20:50:53 Breakout right.  
20:51:19 In light rain and light turbulence and climbing FL230.  
20:51:37 In moderate rain.  
Light to moderate turbulence.  
20:51:42 Nearby flash ahead.  
20:51:47 Moderate turbulence, moderate rain.  
20:51:59 Level at 23,000 ft.  
20:52:33 Cloud exit, event. (Event.)  
20:52:39 (AIS and DLite data off. Cockpit video camera off.)

20:52:43 (METRO didn't see camera trigger on that strike.)

AIS record 7 - Penetration #6, FL230, 130°.

20:53:59 Data on. (Cockpit video camera on.)  
20:54:04 SPANDAR: 135°, 7 miles, level 5.  
20:54:10 (AIS and DLite data on. Time code stable.)  
20:54:12 Penetration #6, FL230.  
20:54:33 (Event for cloud entry.)  
20:54:34 Cloud entry.

20:54:39 Light rain and light turbulence.  
20:54:49 At cloud entry.  
20:54:55 Nearby flashes ahead. About 130° now.  
20:55:04 Moderate rain, light to moderate turbulence.  
20:55:05 Nearby flash.  
20:55:14 Nearby flash.  
20:55:16 Other conditions unchanged.  
20:55:28 Lots of good vertical developement.  
20:55:42 Moderate rain, light to moderate turbulence.  
20:56:24 Cloud exit.  
20:56:26 Event. (Event for cloud exit.)  
20:56:30 Data off.  
20:56:31 (AIS and DLite data off. Cockpit video camera off.)

AIS record 8 - Penetration #7, FL230, 320°.

20:57:47 Data on. (Cockpit video camera on.)  
20:57:50 (AIS and DLite data on. Time code stable.)  
20:57:55 Penetration #7, FL230.  
20:58:23 Cloud entry.  
20:58:24 (Event for cloud entry.)  
20:58:34 Very light rain, light turbulence.  
20:58:44 SPANDAR: Level 5, 315°, 7 miles.  
20:58:53 We'll be passing to the north of that.  
20:58:57 (Radar Scan)  
20:59:24 Continuous light rain with occassional burst to moderate.  
20:59:27 Light turbulence with occassional burst to moderate.  
20:59:44 Nearby flash ahead.  
20:59:57 Very close flashes.  
20:59:58 Moderate turbulence, light to moderate rain.  
21:00:06 Now steady moderate rain.  
21:00:29 0° tilt.  
21:01:10 Cloud exit.  
21:01:11 (Event for cloud exit.)  
21:01:20 (AIS and DLite data off. Cockpit video camera off.)

21:01:22 Data off.  
21:01:40 METRO: Norm says UHF is down for a few minutes.

AIS record 9 - Penetration #8, FL230, 155°.

21:02:38 Data on. (Cockpit video camera on.)  
21:02:50 (AIS and DLite data on. Time code stable.)  
21:02:55 Cloud entry, event. (Event.)  
21:03:02 Penetration #8, FL230, 155° initial heading.  
21:03:34 0° tilt.  
21:03:59 Light rain, light turbulence.  
21:04:12 Good strike! (DLite LeCroy triggers 1,2 and 4. Cockpit video camera records a strike. External movie camera triggers automatically and records a strike.)  
21:04:13 Direct strike to aircraft. 3 triggers.  
21:04:17 Light rain, negligible turbulence at the time.  
21:04:19 Moderate noise.  
21:04:26 METRO: Got a camera trigger.

21:04:33 Nearby flash ahead.  
21:04:35 Rain going to moderate turbulence to light.  
21:04:44 How are these strikes correlating with your updraft theory?  
21:04:50 Hasn't been a real strong correlation with those, or I'd have noticed it.  
21:05:21 Cloud exit. Event.  
21:06:01 Leave data on just in case.  
21:06:27 (AIS and DLite data off. Cockpit video camera off.)  
  
21:06:28 Cycle data systems.  
  
AIS record 10 - Penetration #9 and 10.  
  
21:06:52 Data on for penetration #9, FL230, (Cockpit video camera on.)  
21:06:55 Cloud entry and heading of 330°.  
21:07:00 (AIS and DLite data on. Time code stable.)  
21:07:01 SPANDAR: 340°, 7 miles, level 5.  
21:07:13 -2°.  
21:07:17 0°.  
21:07:20 +2°.  
21:07:22 Light rain, light to moderate turbulence.  
21:07:26 Nearby flashes ahead.  
21:07:33 Lots of nearby flashes.  
21:08:02 Light rain, light to moderate turbulence.  
21:08:05 Now moderate turbulence, moderate rain.  
21:08:24 Getting very bright.  
21:08:26 Cloud exit - event.  
21:09:01 Event for cloud entry. (Event. Begin Penetration #10.)  
21:09:12 Penetration #10, FL230, heading 255°.  
21:09:17 In light rain,  
21:09:20 Extremely bright.  
21:09:35 Cloud exit. (Event.)  
21:09:40 (AIS and DLite data off. Cockpit video camera off.)  
  
21:09:43 Data off.  
21:10:16 I think Stormscope is shot. Points just sit there in the same place in cell ranges.  
  
AIS record 11 - Penetration #11, FL230, 120°.  
  
21:11:15 Data on. (Cockpit video camera on.)  
21:11:20 -2°.  
21:11:28 Cloud entry, event. (Event.)  
21:11:30 Moderate turbulence. (AIS and DLite data on. Time code stable.)  
21:11:33 This is penetration #11, 120°, FL230.  
21:11:39 Moderate turbulence, no rain.  
21:12:10 SPANDAR: Level 5, about 2 miles, 135°.  
21:12:19 Out in the clear between turrets right now.  
21:12:21 (Event for cloud exit.)  
21:12:28 (Event for reentry.)  
21:12:29 Cloud entry.  
21:12:34 Nearby flashes.  
21:12:35 Moderate rain, moderate turbulence.

21:12:38 More nearby flashes.  
21:12:53 Getting very dark.  
21:13:00 Cloud exit...  
21:13:02 Event.  
21:13:08 Data off. (AIS and DLite data off. Cockpit video camera off.)  
  
21:13:19 Radome looks OK, to the extent that I can see it.  
  
AIS record 12 - Penetration #12, FL230, 200°.  
  
21:13:37 Data on with your call. (Cockpit video camera on.)  
21:13:40 (AIS and DLite data on. Time code stable.)  
21:13:46 Penetration #12, FL230, 240°.  
21:14:10 Strike.  
21:14:10.1 (DLite LeCroy triggers 1,2 and 4. Cockpit video camera records a strike. External movie camera triggers automatically and records a strike.)  
  
21:14:13 3 triggers.  
21:14:20 Brighter than the last one, otherwise similar.  
21:14:26 Cloud exit...  
21:14:27 Event.  
21:14:35 METRO: (Camera triggered.)  
21:14:53 (AIS and DLite data off. Cockpit video camera off.)  
  
21:14:55 Data off momentarily.  
  
AIS record 13 - Penetration #13, FL230, 280°.  
  
21:15:25 Data on. (Cockpit video camera on.)  
21:15:30 (AIS and DLite data on. Time code stable. Cloud entry.)  
21:15:33 Penetration #13, FL230, heading 280°.  
21:15:43 SPANDAR: 270°, 7 miles, level 5.  
21:15:47 We see level 3.  
21:15:58 (External movie camera triggers automatically.)  
21:15:59 Nearby flash on left.  
21:16:09 METRO: We had a camera trigger.  
21:16:16 Moderate rain.  
21:16:17 Nearby flash, light to moderate turbulence.  
21:16:22.5 (DLite LeCroy triggers 1,2 and 4. Cockpit video camera records a strike. External movie camera triggers automatically and records a strike.)  
  
21:16:23 Very close! That must have been a strike.  
21:16:27 Triple triggers right there.  
21:16:31 In moderate turbulence. 1000 ft./min. updraft, light to moderate rain.  
  
21:16:37 Hard jolts, moderately hard jolts, and the strike was silent.  
21:17:23 Cloud exit...  
21:17:24 Event.  
21:17:34 (AIS and DLite data off. Cockpit video camera off.)  
  
21:17:36 Data off.  
  
AID record 14 - Penetration #14, FL230.



21:18:28 Data on. (Cockpit video camera on.)  
21:18:33 Cloud entry...  
21:18:39 Penetration #14, FL230  
21:18:40 (AIS and DLite data on. Time code stable.)  
21:18:44 Moderate to heavy turbulence.  
21:18:45 Light rain.  
21:18:57 Ice on windshield now.  
21:19:04 -2°.  
21:19:07 +2°.  
21:19:36 Some flashes up here.  
21:19:51.5 (DLite LeCroy triggers 1,2 and 4. External movie camera triggers automatically. LeCroy data indicates a strike.)  
21:19:52 Very close flashes. In fact, we got 3 triggers.  
21:19:58 Moderate rain, light to moderate turbulence.  
21:20:03 Getting very dark.  
21:20:17 Very close flashes ahead.  
21:20:18 (External movie camera triggers automatically.)  
21:20:23 Light rain, light turbulence.  
21:20:28 METRO: Had camera trigger.  
21:20:38 More flashes overhead.  
21:21:35 Cloud exit...  
21:21:37 Event.  
21:21:50 (AIS and DLite data off. Cockpit video camera off.)  
  
21:21:51 Data off.  
  
AIS record 15 - Penetration #15, FL230, 320°.  
  
21:23:20 (AIS and DLite data on. Time code stable.)  
21:23:27 Penetration #15, FL230, heading 320°.  
Data came on at cloud entry.  
21:24:01 Nearby flash.  
21:24:03 Calm and dry now.  
21:24:14 Very light rain and light turbulence.  
21:24:18 (Radar Scan.)  
21:24:36 (External movie camera triggers automatically.)  
21:24:37 Extremely close flashes.  
21:24:39 Immediately go to moderate turbulence and light rain.  
21:24:42 Updraft.  
21:24:58 Moderate turbulence and light rain.  
21:25:14 Cloud exit on right only. Between cells.  
21:25:28 SPANDAR: 300°, 7 miles, level 5.  
21:25:33 We see red at that position.  
21:25:58 0° tilt.  
21:26:00 Moderate turbulence; light rain.  
21:26:05 Now moderate rain, light to moderate turbulence.  
21:26:12 Heavy rain, light to moderate turbulence.  
21:26:18 Rain falls off to moderate.  
21:26:21 Rain falls off to light.  
21:26:26 Good vertical development through here.  
21:26:28 Cloud exit...  
21:26:30 Event.  
21:26:38 Data off. (AIS and DLite data off. Cockpit video camera off.)

21:28:01 METRO: Vlad would like you to drop down to 19.  
AIS record 16 - Penetrations #16 and 17.

21:28:09 Data on. (Cockpit video camera on.)  
21:28:16 Penetration 16, FL230, 120°.  
21:28:29 (Event for cloud entry.)  
21:28:30 (AIS and DLite data on. Time code stable.)  
21:28:31 Cloud entry, event.  
21:28:36 Moderate turbulence and moderate rain immediately.  
21:28:44 Nearby flash and heavy rain.  
21:28:49 Moderate turbulence along with this.  
21:28:55 Rain falls off to light, turbulence stays light to moderate.  
21:28:57.9 (DLite LeCroy triggers 1,2 and 4. Cockpit video camera records a strike.)

21:29:02 We've had triggers.  
21:29:04 Yeah. I saw the flash. It was real faint.  
21:29:08 METRO: We have triggers!  
21:29:32 Breakout on the left, as usual, between these cells.  
21:29:59 Light rain, light to moderate turbulence.  
21:30:18 (External movie camera triggers automatically.)  
21:30:19 Very close flash - Forward.  
21:30:21 METRO: You had a camera flash.  
21:31:25 (External movie camera triggers automatically.)  
21:31:26 Flashes out here in the veil.  
21:31:34 Dark in here, too.  
21:31:50 METRO: Lot of field mill activity.  
21:31:50 Gonna keep data on. Running down bottom side of anvil, I believe.

21:32:12 METRO: Good field mills now.  
21:32:16 Nearby flash.  
21:32:30 SPANDAR: Small area of level 5 in that cell, about 310°, 12 miles.  
21:32:38 That's where we see the peak reflectivity. Only green and yellow at this time.  
21:32:50 (Radar Scan)  
21:32:55 (Event to end Penetration #16 and begin Penetration #17.)  
21:33:06 Event in record to start penetration #17, FL190.  
(End of cockpit voice tape.)  
21:33:19 285°.  
21:33:24 Cloud entry.  
21:33:25 (Event for cloud entry.)  
21:33:30 Moderate turbulence.  
21:33:44 Continuous light turbulence, moderate rain.  
21:34:00 Moderate rain. It's forming sheets on the windscreen.  
21:34:09 In the clear. (Cloud exit.)  
21:34:28 Event for reentry.  
21:34:32 Nearby flashes.  
21:34:36 Moderate rain.  
21:34:38 Moderate turbulence.  
21:34:44 Let the red pass down our right side.  
21:34:48 Moderate rain, moderate turbulence.  
21:35:07 Excellent vertical bumps.  
21:35:26 Reentered a small turret now.

21:35:28 Moderate rain, moderate turbulence.  
21:35:33 Cloud exit. (Event.)  
21:35:38 (AIS and DLite data off. Cockpit video camera off.)

21:35:39 Data off.  
(Radar Scan.)  
21:37:53 SPANDAR: 150°, 12 miles, level 5.  
21:37:58 SPANDAR: 150°, 12 miles, level 5.  
21:38:05 We see green and yellow at those locations.

AIS record 17 - Penetration #18, FL190, 150°.

21:38:10 Data on. (Cockpit video camera on.)  
21:38:17 (Event for cloud entry.)  
21:38:18 Cloud entry.  
21:38:20 (AIS and DLite data on. Time code stable.)  
21:38:26 Penetration #18, FL190, 150°.  
21:38:34 Moderate rain, light to moderate turbulence.  
21:38:39 SPANDAR: 150°, 10 miles, level 6. Small area.  
21:38:47 We see green and yellow ahead.  
21:38:52 Moderate rain, light to moderate turbulence.  
21:39:08 Moderate turbulence, rain falls off to light.  
21:39:14 SPANDAR: Level 6, due south your position, 3 miles.  
21:39:18 We're going to pass to the east of that.  
21:39:36 No, I see red. We'll let it go down the left side, to our east.  
21:39:44 Moderate rain, moderate turbulence.  
21:39:49 Burst of heavy rain, moderate turbulence.  
21:40:05 Cloud exit...  
21:40:07 Event.  
21:40:33 (AIS and DLite data off. Cockpit video camera off.)

AIS record 18 - Penetration #19, FL190.

21:40:51 Data on. (Cockpit video camera on.)  
21:40:54 (Event for cloud entry.)  
21:40:55 Event, cloud entry.  
21:41:01 Under the anvil now.  
21:41:11 Penetration #19, FL190.  
21:41:16 We are in the hazy clouds at the bottom of the anvil.  
21:41:36 SPANDAR: 290°, 5 miles, level 6.  
21:41:38 SPANDAR: 310°, 12 miles, level 6.  
21:41:43 We see red in that location. We're going to deviate to the north to avoid that.  
21:41:54 Nearby flashes.  
21:41:55 Moderate turbulence, moderate rain.  
21:42:01 Moderate to heavy turbulence through here, now heavy rain.  
21:42:41 Now in light rain, light turbulence - occasional moderate.  
21:42:50 Now moderate rain, moderate turbulence.  
21:43:01 36 miles out.  
21:43:05 Heavy rain, moderate turbulence.  
21:43:09 Moderate rain, moderate turbulence.  
21:43:31 (Event for cloud exit.)  
21:43:35 Mark records as we come out.  
21:43:36 Now go back in again.

21:43:39 (Event for reentry.)  
21:43:44 Penetrating a secondary turret.  
21:43:50 We were seeing moderate rain and moderate turbulence.  
21:43:59 A third turret, and same conditions exist here as before.  
21:44:04 Moderate rain, moderate turbulence.  
21:44:17 Cloud exit. (Event.)  
21:44:23 (AIS and DLite data off. Cockpit video camera off.)

AIS record 19 - DLite LeCroy cals.

21:45:40 (AIS and DLite data on. Cockpit video camera on.)  
(Two sets of DLite LeCroy cals.)  
21:47:01 (AIS and DLite data off. Cockpit video camera off.)  
  
21:47:10 (Cockpit voice recorder off.)  
21:47:19 (Radar video recorder off.)  
21:47:43 (DLite instrumentation off.)  
21:49:23 (DLite instrumentation on.)  
(Start DLite data without AIS data.)

AIS record 20 - Landing.

21:57:10 (AIS data on. Cockpit video camera on.)  
(Run out external movie camera film in manual mode.)  
21:58:08 (Landing.)  
21:59:11 (AIS data off. Cockpit video camera off.)  
  
22:00:04 (DLite instrumentation off.)  
22:01:08 (DLite master power off.)

AIS record 21 - Chocks.

22:03:00 (AIS data on. Cockpit video camera on.)  
22:03:54 (AIS data off. Cockpit video camera off.)  
  
(Stop recorder for cockpit video camera.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-043 F-106B

Date August 8, 1984

Crew Brown/Fisher

Engine Start 20:10:34

Take-off 20:19:19

Landing 21:58:08

## Lightning Systems:

Dlite 6 Triggers

40ns LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F$  NG

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK \*

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

\* Turned off by power cycle.

Aft movie camera 3 Strikes. Auto. 400 pps.

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 5 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Coinjock, NC

Pens 19

Strikes 6

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 043

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures NUWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR PINOPUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NUELF Antenna NULLP OKWFF Plots OKLaRC Plots INOPWFF Tape OK

Debrief Notes for Flight 84-044, August 9, 1984.

Storm Flight/Dismal Swamp, VA

Brown/Winebarger

GMT

AIS Record 1 - Video Check.

17:51:50 (AIS data on.)  
17:52:07 (AIS data off.)  
17:58:00 Engine start.

AIS Record 2 - Takeoff.

18:28:20 (AID data on.)  
18:28:36 (Lift off.)  
18:29:34 (AIS data off.)

AIS Record 3 - Pen #1.

18:34:20 (Data on.)  
18:34:28 (Event - storm entry)  
18:34:29 In the storm. Heading 200°, climbing to 15.  
18:34:39 Moderate precip.  
18:35:00 Good bounce and heavy precip now.  
18:35:13 15,000 ft.  
18:35:40 SPANDAR: Show level 5, 160°, about 5 miles.  
18:35:54 (Event - 1st cell exit.)  
18:36:00 We're between 2 cells. Saw a flash between them.  
18:36:11 Flashes right ahead.  
18:36:36 Another one.  
18:36:38 We had a beautiful column right beside us here. From  
two clouds.  
18:36:50 (Event - 2nd cell entry.)  
18:36:52 Back in the rain.  
18:37:08 Lots of flashes.  
18:37:55 Heavy rain here.  
18:38:10 (Event - storm exit.)  
18:38:11 (Data off.) Out in clear. Data off.

AIS Record 4 - Pen #2.

18:39:30 (Data on.)  
18:39:32 (Event - storm entry.)  
18:39:35 METRO: I'd like you to go to 18.  
18:39:42 SPANDAR: 320°, 7 miles, show small area of level 6.  
290°, 5 miles, small area of level 5.  
18:40:27 Certainly got moderate to heavy rain, I think.  
18:40:31 Been in heavy rain for a good while now.

18:40:51 We're out. (Event - storm exit.)  
18:40:54 (Data off.)  
18:43:04 Lots of lightning flashes ahead.  
18:43:12 Almost continuous flashes.  
18:43:24 SPANDAR: 210°, 7 miles, level 5.  
18:43:28 We see a spot of red there.  
18:43:37 See lots of flashes. Should have stormscope activity on that one.  
18:43:42 We do.

## AIS Record 5 - Pen #3.

18:44:05 Data on. Penetration 3, 19,000 ft, heading 190°.  
18:44:10 (Data on. Oh boy! Another big channel.)  
18:44:17 (Event - storm entry.)  
18:44:18 Storm entry.  
18:44:27 Turbulence.  
18:44:30 Moderate turbulence, flashes.  
18:44:34 METRO: Good field mills and camera flash.  
18:44:41 More flashes and heavy rain.  
18:44:44 Good bounces there.  
18:44:52 Hard bounce.  
18:45:02 (Event - cell exit.)  
18:45:03 We're out and a little one ahead we are going thru.  
18:45:35 (Event - 2nd cell entry.)  
18:45:36 We're in this one, immediate moderate rain.  
18:45:48 (Event - storm exit.)  
18:45:49 Out.  
18:45:54 (Data off.)  
18:46:17 METRO: UHF request 23,000.  
18:46:58 SPANDAR: 040°, 5 miles, level 5.  
18:47:00 We see red. (Radar scan and back to 0°.)  
18:47:28 METRO: We see lot of lightning in storm ahead of you.  
18:47:31 Stormscope is going crazy.

## AIS Record 6 - Pen #4.

18:47:50 (Data on. In the storm. Heading 080°, altitude 227.  
18:48:03 Now 23.  
18:48:06 Lots of flashes.  
18:48:21 Light rain.  
18:48:40 SPANDAR: The area you went thru, now some level 6 in it.  
18:49:14 (Data off - still in cloud.)  
18:50:40 SPANDAR: 10 miles, level 5.

## AIS Record 7 - Pen #5.

18:50:50 (Data on.)  
18:50:54 Data is on for penetration 5, heading 280°, altitude 23,000.  
18:51:25 Lots of flashes.  
18:51:40 We'll let the red pass to our left.



18:51:50 Lots of flashes and we have red on our left.  
18:51:50 (LeCroys triggered but no data and cockpit video recorded strike.)  
18:51:51 Strike! Left side.  
18:52:03 Lots of flashes.  
18:52:09 METRO: Camera is going wild.  
18:53:19 Ice on side of canopy and windscreen.  
18:53:20 (Event - storm exit.)  
18:53:27 Data off.)  
18:53:30 Out in the clear.  
18:54:00 I've never seen a channel like that in front of the airplane that I didn't see it sweep back over the canopy.  
18:54:05 Maybe it went under the fuselage.

## AIS Record 8 - Pen #6.

18:54:59 In the storm for penetration 6.  
18:55:00 (Data on.)  
18:55:07 SPANDAR: Still have level 5, same position.  
18:55:14 Good turbulence. Heading 75°, altitude 23,000.  
18:55:30 Little bit of strong turbulence there.  
18:55:32 Flashes.  
18:55:34 Updraft.  
18:55:36 Lots of flashes.  
18:55:50 Sounds like some solid stuff in that. (Could hear it on tape.)  
18:56:33 (Event - storm exit.)  
18:56:34 (Data off.)  
18:57:02 Almost continuous flashes all way thru on that trip.

## AIS Record 9 - Pen #7.

18:58:00 Data on for penetration 7. We are still turning. Altitude 23.7.  
18:58:20 In the cloud already. Not to contour. (Radar scan.)  
18:58:41 Heading west.  
18:58:52 Flashes.  
18:58:58 Lots of flashes now.  
18:59:25 Moderate to heavy turbulence.  
18:59:31 (Cockpit video recorded strike.)  
18:59:32 Strike. Right side.  
18:59:34 No triggers.  
18:59:39 Quiet, like the other one was.  
18:59:45 Kinda well defined narrow, small size channel.  
18:59:57 Moderate to heavy turbulence.  
19:00:04 Updrafts.  
19:00:08 (Event - storm exit.) We're out.  
19:00:20 (Data off.)

## AIS Record 10 - Pen #8.

19:02:58 Data on for penetration 8, heading 095°, altitude 23.7.  
19:03:00 (Data on.)  
19:03:26 Flashes.  
19:03:40.6 (LeCroys 1,2 & 4 triggered and Aft camera and video camera recorded strike.)  
19:03:42 I don't know if a strike. It was awful close.  
19:03:44 Close flash. It triggered.  
19:03:48 METRO: We showed strike.  
19:05:28 (Storm exit.)  
19:05:34 (Data off.)

## AIS Record 11 - Cloud Record.

19:06:20 (Data on.)  
19:06:30 (Data off.)  
Strobeing on radar.  
19:09:11 SPANDAR: Level 5, the whole line.

## AIS Record 12 - Pen #9.

19:09:47 Data is on. FL 23, Heading 325°.  
19:09:50 (Data on.)  
19:09:51 Just entered the storm.  
19:10:17 Lots of flashes.  
19:10:27 METRO: Good field mills.  
19:10:32 Light precip.  
19:10:34 Moderate turbulence.  
19:10:36 Lots of flashes.  
19:10:47 Lots of updrafts- big updrafts.  
19:10:57 Moderate turbulence, light precip.  
19:11:53 Flashes.  
19:11:58 Heavy, heavy rain.  
19:12:09 Real strong updraft. Very strong.  
19:12:14 Flashes above, then.  
19:12:26 Distant flashes.  
19:13:11 Lot of flashes.  
19:13:39 Still getting flashes.  
19:14:22 (Data off.) (Still in clouds.)  
19:14:43 I'm going to call that penetration 10 and the thing before nothing.

## AIS Record 13 - Pen #10.

19:15:50 (Data on.)  
19:15:52 Data on for penetration 11, heading 130°, altitude 23,000.  
19:16:03 SPANDAR: 135° small area level 5, 15 miles.  
Large area 20 - 25 miles.  
19:16:17 Lot of flashes.  
19:16:42 Flashes.

19:16:56 SPANDAR: 135°, 5 miles, level 5.  
19:17:14 Lot of flashes.  
19:17:17 We're passing to the east of some red.  
19:17:37 Awful close. (Bright on video.)  
19:17:38 Close bright flashes there.  
19:18:06 Moderate turbulence.  
19:18:12 Distant flashes.  
19:18:15 SPANDAR: 150°, level 6, 7 miles.  
(Radar scan.)  
19:19:05.5 (LeCroys 1, 2 & 4 triggered.)  
19:19:08 Bright flashes.  
19:19:11 METRO: I saw triggers, did you get a strike?  
19:19:13 Didn't see a strike but we got triggers.  
19:19:17 METRO: Strike four.  
19:19:22 Updraft.  
19:19:35 At the time we got triggers it was moderate turbulence,  
light precip.  
19:20:32 SPANDAR: 200°, 5 miles, level 5.  
19:20:50 We will stay to the left of the red.  
19:21:29 Moderate turbulence.  
19:21:49 (Data off.)  
19:24:30 SPANDAR: 330°, level 5.

AIS Record 14 - Pen #11.

19:24:30 (Data on.)  
19:24:40 Data on for penetration 12, heading 350°, altitude  
23,000. Back in.  
19:24:45 METRO: Good field mills and UHF says lots of lightning.  
19:25:01 Light precip, good turbulence.  
19:25:12 Distant flashes.  
19:25:21 Momentary breakout.  
19:25:29 SPANDAR: Right ahead, due north your position, 7 miles,  
level 5. Runs northwest from there for about 10-15 miles.  
Has level 6 on northwest corner.  
19:26:29 Flashes.  
19:26:50 More flashes.  
19:27:06 (Aft camera and cockpit video recorded a strike.)  
19:27:16 Updraft.  
19:27:58 Lots of flashes.  
19:28:03 Bright flashes.  
19:28:10 More bright flashes, moderate turbulence, light precip.  
19:28:37 More flashes.  
19:28:44 Not many strikes for all these flashes.  
19:29:05.4 (LeCroys 1, 2 & 4 triggered and cockpit video recorded  
a strike.)  
19:29:06 Strike. Right front.  
19:29:09 METRO: We got triggers.  
19:29:17 It was close to the edge of the fuselage.  
19:30:00 (Data off.)

## AIS Record 15 - Pen #12.

19:30:20 (Data on.)  
19:30:28 SPANDAR: 110°, 3 miles, level 5.  
135°, 10 miles, level 5.  
19:30:40 Cycled data for penetration 13, heading 120, altitude  
23,000, and getting lots of flashes.  
19:31:09 Real bright flashes.  
19:32:18 Still haven't seen the precip to match the colors we've  
seen on radar. Have you?  
19:32:20 No. I agree.  
19:32:33 Lot of flashes  
19:32:50 Updrafts.  
19:33:03 SPANDAR: 180, 8 miles, level 5.  
19:33:10 We haven't seen the precip to match the radar returns  
from our or yours.  
19:34:17 Distant flashes.  
19:35:30 (Data off.)

## AIS Record 16 - Pen #13.

19:35:50 (Data on.)  
19:35:55 SPANDAR: 315°, 5 miles and 10 miles, level 5.  
19:36:08 Cycled the data again for penetration 14, heading 320,  
altitude 226.  
19:36:30 Fuel 3.9. BINGO after this one.  
19:36:46 Lots of flashes.  
19:37:00 Breakout to the left.  
19:37:29 Moderate turbulence and lots of flashes.  
19:37:49 We might have gotten a strike there.  
19:37:51 That one was close but it didn't trigger.  
19:40:20 (Out of clouds.)  
19:41:00 (Out of clouds.)  
19:41:04 Few flashes.  
19:42:26 Getting a lot of flashes as we are coming down.  
19:43:30 Coming up on 10,000.  
19:43:58 Now 8,000.  
19:44:10 Now 6,000.  
19:45:59 (Data off.)

## AIS Record 17 - Landing.

19:47:50 (AIS data on.)  
19:50:12 (Touchdown.)  
19:51:30 (AIS data off.)

## AIS Record 18 - Chocks.

19:57:30 (Ais data on.)  
19:58:12 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 044 F-106B

Date August 9, 1984

Crew Brown/Winebarger

Engine Start 17 :58 : 00

Take-off 18 :28 : 36

Landing 19 :50 :12

Lightning Systems:

Dlite 3 Triggers

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 2 Strikes. Auto. 400 pps.

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 5 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Dismal (Swamp),

VA

Pens 13

Strikes 6

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-044

## Ground-Based

Metro

## Telemetry

Strip Charts OK

PCM Data OK

## Kavouris System

Basic Display OK

INS Overlay OK

Triggers OK

Videotape OK

Satellite Pictures OK

Wallops

SPANDAR OK

Videotape OK

Digital dBZ Tape INOP

LDAR OK

UHF Radar OK

C-Band Tracking OK

Goddard Antennas OK

GSFC NU

WFF OK

LaRC NU

ELF Antenna INOP

LLP OK

WFF Plots OK

LaRC Plots OK

WFF Tape OK

Debrief Notes for Flight 84-045, August 9, 1984

Storm Flight/Rockville, VA

Brown/Winebarger

GMT

21:10:30 Engine start.

AIS Record 1 - Takeoff.

21:19:00 (AIS data on.)

21:19:29 (Liftoff.)

21:20:11 (ASI data off.)

AIS Record 2 - Pen #1.

21:32:50 (Data on.) (In clouds.)

21:33:01 We have about 7 miles to go to the first contour.

21:33:27 Flashes.

21:33:57 Heading 325°, altitude 18,000.

21:34:08 Bright flashes.

21:34:20 Smooth clouds so far, occasional lightning flashes.

21:34:25 METRO: Very active field mills in there.

21:34:37 SPANDAR: 315°, 2 miles, level 5.

21:34:49.6 (LeCrois 1,2 & 4 triggered and cockpit video camera recorded a strike.)

21:34:50 Good strike!

21:34:51 Triggers.

21:35:08 That was in smooth cloud. No turbulence. No precip.

21:35:23 Now we are getting precip - moderate.

21:35:44 Momentary breakout to left there.

21:35:54 Heavy precip.

21:36:03 Big updraft.

21:37:38 (Event - storm exit.)

21:37:46 (Data off.)

AIS Record 3 - Pen #2.

21:38:35 Data on for penetration #2.

21:38:40 (Data on.)

21:38:41 We are in the cell. Heading 175°, altitude 18,000.

21:40:00 Heavy precip.

21:40:04 SPANDAR: 135°, 5 miles, level 5.

21:40:08 We don't see that.

21:40:36 Heavy percip.

21:40:42 Moderate turbulence.

21:41:53 Heavy percip again.

21:41:59 Good bump.

21:42:00 Rain quit.

21:43:20 Metro, do field mills show worth keeping data on?  
21:43:26 METRO: Negative.  
21:43:27 (Data off.)  
SPANDAR: 260°, 10 miles, level 5. Small area.

## AIS Record 4 - Penetration 3.

21:46:08 Data on for penetration 3. We've entered the cloud  
heading 240°, altitude 18,000.  
21:46:10 (Data on.)  
21:46:38 METRO: Starting to see some field mills.  
21:46:52 Getting some precip now.  
21:47:02 Distant flash.  
21:47:32 Light to moderate precip.  
21:47:48 (Out of 1st cell.) Momentary breakout.  
21:47:54 The cells are small.  
21:48:48 (2nd cell entry.) In next cell now.  
21:48:52 Moderate turbulence and pretty heavy precip.  
21:49:24 SPANDAR: You have exceeded the range of our color  
display. No longer can we give you the levels.  
21:49:37 (Event - storm exit.)  
21:49:40 (Data off.)  
21:50:25 Did you see that?  
21:50:26 No.  
21:50:27 It went from as far above as I could see to as far  
below as I could see.  
21:50:32 On our left?  
21:50:34 Yeah. Right down beside that column.

## AIS Record 5 - Pen #4.

21:51:00 (Data on.)  
21:51:00 Penetration 4. Heading 020°, altitude 177.  
21:51:10 Heavy precip now.  
21:51:14 Briefly.  
21:51:20 SPANDAR: 025°, 10 miles, level 5.  
21:51:40 (1st cell exit.) Breaking out of that one.  
21:52:28 (2nd cell entry.)  
21:52:31 Heavy precip.  
21:53:14 Moderate turbulence.  
21:53:16 Moderate precip.  
21:53:25.2 (LeCroys 1, 2, & 4 triggered and cockpit video recorded  
a strike.)  
21:53:26 Gosh! Now that was a big on.  
21:53:27 Sounded like couple bumps.  
(Could hear on tape.)  
21:53:29 A big strike. Sounded like a couple of booms with it.  
21:53:32 And a thump to airplane.  
21:53:39 Had triggers.  
21:53:43 METRO: Where did it hit?  
21:53:48 Bottom of nose, I think.



21:54:03 I felt it in my feet. It felt like something banged  
up against the bottom of the airplane.  
21:55:12 This is a dark cloud - not to have shown up on radar.  
21:55:46 (Data off.)  
21:55:47 I think EPR is broken. Struck at 2.35.

AIS Record 6 - Pen #5.

21:56:50 (Data on.)  
21:56:54 Data is on for penetration 5. Back in the cloud.  
Heading - in right turn.  
21:57:07 177 on altitude, leveled out at 290° heading.  
21:57:32 Lots of flashes.  
21:58:29 Getting some precip briefly.  
21:58:48 Heavy precip.  
21:58:52 I'd call this moderate to occasionally heavy turbulence.  
21:58:57 (Event - 1st cell exit.)  
21:58:59 Breakout.  
21:59:50 (2nd cell entry.)  
21:59:55 Heavy rain.  
22:00:18 (Event - 2nd cell exit.)  
22:00:19 SPANDAR: You have exceeded my color display range.  
I can no longer guide you.  
22:00:32 (Event 3rd cell entry.)  
22:00:34 Getting heavy rain again.  
22:00:48 (Event = storm exit.) Hard bounce just as we exited there.  
22:00:51 (Data off.)

## AIS Record 7 - Pen #6.

22:01:39 Data is on for penetration 6. As we come around  
the turn we are penetrating a cell. In heavy precip  
right now.  
22:01:50 (Data on:) Heading 355°.  
22:03:08 Heavy precip now.  
22:04:00 (1st cell exit.) Broke out for a minute now. Getting  
ready to go in on another one.  
22:04:24 (2nd cell entry.) Back in another cell.  
22:04:32 Heavy precip now.  
22:04:37 Updraft.  
22:05:28 (Storm exit.) Broke out now.  
22:05:32 (Data off.)  
22:06:19 Wow good one! (Visually from outside the storm.)  
22:06:55 We are going thru clouds that don't show on the radar.  
If any of them look worth it tell me to turn data on.

## AIS Record 8 - Pen #7.

22:07:07 I'll bring it on anyway.  
22:07:15 Little bit of field mill showing, not really too much.  
22:07:20 (Data on.)  
22:07:24 That was starting to feel like a storm so I brought  
it on.

22:07:43 Penetration 7, altitude 18,000, heading 55°.  
22:07:58 However, nothing is showing on the radar.  
22:08:29 SPANDAR: 045°, 20 miles, level 5.  
22:08:42 We're in dark cloud now.  
22:10:46 Flashes.  
22:10:49 METRO: Good field mills.  
22:10:52 More flashes. This is a dark cloud.  
22:11:07 Heavy precip.  
22:11:11 Hard bounce there.  
22:11:19 Heavy precip.  
22:11:33 Precip was heavy enough that time, to attenuate storm beyond it.  
  
22:12:11 Heavy precip.  
22:12:17 Very heavy precip.  
22:12:20 (Event - 1st cell exit.) We broke out, got another cell at 7 miles.  
  
22:13:11 (Event - 2nd cell entry.) Back in cloud before getting to contour. 45-6.  
  
22:13:44 We have a good spot of red we are flying to the west of.  
22:13:50 Heavy precip.  
22:14:04 Momentary breakout to right.  
22:14:09 Bright flash there. (To left.)  
22:14:40 Bright flash.  
22:14:44 Cloud getting much brighter.  
22:14:52 (Event - cell exit.) Breakout.  
22:13:21 One more little cell to pick up before repenetration.  
22:15:45 (Event - 3rd cell entry.) In it.  
22:16:06 A little turbulence and light precip is about all it seems to be to this one.  
  
22:16:21 Now moderate precip.  
22:16:29 Occasional heavy.  
22:16:33 (Event - storm exit.)  
22:16:34 We're out.  
22:16:44 (Data off.)  
22:17:34 Did you see that bolt over there?  
22:17:35 Yeah.  
22:17:38 SPANDAR: A line running about due east of you, little bit of north of east, a little level 5 about 10 miles from you. Appears to be hottest area as far as intensity goes.

## AIS Record 9 - Penetration 8.

22:18:28 Data is on for penetration 8. Heading 070°, altitude 18,000.  
22:18:30 (Data on.)  
22:18:40 Just in smooth cloud now.  
22:19:28 Heavy precip.  
22:19:36 Very heavy precip now.  
22:19:42 Bright flashes.  
22:20:03 (Event - 1st cell exit.)  
22:20:08 Breakout.  
22:20:42 (Event - 2nd cell entry.)  
22:20:43 Back in.

22:21:30 Flashes.  
22:22:06 SPANDAR: 150°, 4 miles.  
160°, 7miles, level 5.  
22:22:38 Getting some heavy precip and moderate turbulence.  
22:22:40 Updraft.  
22:23:10 Flashes.  
22:23:38 More flashes.  
22:23:46 Atleast moderate rain.  
22:24:01 Bright flashes.  
22:24:02 A small click also in head set.  
22:24:51 Flashes.  
22:25:08 Just in dark smooth cloud again.  
22:25:17 Distant flashes.  
22:26:39 (Data off.)

AIS Record 10 - Pen #9.  
22:26:50 (Data on.)  
22:27:05 Data cycle for penetration 9, altitude 177, heading 010°.  
22:27:15 Still in cloud.  
22:27:17 With flashes.  
22:27:29 SPANDAR: 360°, 15miles, level 5.  
22:27:47 Distant flashes.  
22:28:01 Some bright flashes.  
22:28:19 Moderate turbulence now.  
22:28:32 Some light precip.  
22:29:02.2 (LeCroys 1, 2, & 4 triggered and cockpit video recorded a strike.)  
22:29:03 Good strike! Left side with triggers.  
22:29:05 That was very loud.  
22:29:11 Loud boom with that.  
22:29:21 (Event - storm exit.)  
22:29:28 (Data off.)  
22:29:39 SPANDAR: 350° about 10 miles.  
22:29:54 SPANDAR: We show some level 5 in that.

AIS Record 11 - Pen #10.  
22:30:00 (Data on.)  
22:30:26 Data is on for penetration 10. We are going thru some light clouds now.  
22:30:42 Last strike occured with light turbulence, and light precip.  
22:30:52 Flashes.  
22:30:56 Fuel balance is good.  
22:31:24 Getting heavy precip now.  
22:31:37 (Storm exit.)  
22:31:38 Hard bump there as we came out of that one.  
22:31:50 (Data off.)

AIS Record 12 - Pen #11.  
22:33:00 (Data on.)

22:33:12 Data is on penetration 11, heading 130°, altitude 175.  
22:33:18 (Event - storm entry.)  
22:33:20 Back in the storm.  
22:33:27 Moderate precip.  
22:33:53 Saw some flashes.  
22:34:07 More flashes.  
22:34:16 Breakout on left side.  
22:34:18 (Event - 1st cell exit.)  
22:34:43 SPANDAR: 60°, 5 miles, level 5.  
22:35:30 (Event -2nd cell entry.)  
22:35:41 Heavy percip.  
22:35:45 We are just skimming the edge of this one because it had  
red center.  
22:35:55 Flashes.  
22:36:20 (Event - storm exit.)  
22:36:22 (Data off.)

## AIS Record 13 - Pen #12.

22:37:30 (Data on.)  
22:37:34 Brought data on, still in turn in cloud.  
22:37:38 Had some flashes.  
22:37:48 Heading 345°, altitude 178.  
22:37:58 SPANDAR: 40°, 5 miles, level 5.  
22:38:16 Flashes.  
22:38:30 Good turbulence.  
22:38:33 Moderate rain. Heavy rain.  
22:38:49 (Event - storm exit.)  
22:38:59 (Data off.)  
22:40:18 Some flashes up in those clouds.  
The ones ahead at 11 o'clock.  
21:41:21 METRO: Data on, 816.

## AIS Record 14 - Pen #13.

22:41:40 (Data on.)  
22:42:12 METRO: Full scale charge.  
22:44:09 (Data off.) (Run out.)  
23:00:09 Touchdown.

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-045 F-106B

Date August 9, 1984

Crew Brown/Winebarger

Engine Start 21 : 10 : 30

Take-off 21 : 19 : 29

Landing 23 : 00 : 05

## Lightning Systems:

Dlite 3 Triggers

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

LeCroy III.1 INOP 2 INOP 3 INOP

5ns LeCroy IV.1 TP100 2 TP 101 3 TP 123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera INOP. JAMMED

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 3 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Rockville, VA

Pens 13

Strikes 3

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 045

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures NUWallopsSPANDAR OKVideotape OKDigital dBZ Tape INOPLDAR OKUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC NUELF Antenna INOPLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-046, August 12, 1984

Storm Flight/Chambers Field, Norfolk, VA

Brown/Winebarger

GMT

AIS Record 1 - Video check.

17:55:10 (AIS data on.)  
17:56:00 (AIS data off.)  
18:17:20 Engine start.

AIS Record 2 - Takeoff.

18:25:30 (AIS data on.)  
18:25:56 (Liftoff.)  
18:26:49 (AIS data off.)

AIS Record 3 - Penetration 1.

18:34:14 Data on for Penetration 1, altitude 15,000. Now getting into  
some of the clouds.  
18:34:20 (Data on.)  
18:34:27 METRO: Field mills are doing it.  
18:34:30 Light precip, and light turbulence.  
18:34:38 Moderate Precip.  
18:35:46 (Event - cell exit.) Momentary breakout.  
18:35:51 (Event - cell entry.)  
18:35:52 Back in the other cell.  
18:35:58 Heavy precip and moderate turbulence.  
18:36:18 (Event - storm exit.)  
18:36:20 Breakout.  
18:36:25 (Data off.)  
(SPANDAR does RHI.)

AIS Record 4 - Penetration 2.

18:37:28 Bring data on to fly thru a little one here in turn.  
18:37:43 (Storm entry.)  
18:37:50 (Data on.)  
18:37:56 In heavy precip.  
18:38:49 (Event - storm exit.)  
18:38:53 (Data off.)

AIS Record 5 - Penetration 3.

18:40:30 (Data on.)  
18:40:33 Data on for penetration 3. In the cloud making left turn  
from 030°, 15,000 ft.  
18:40:37 (Event - storm entry.)  
18:40:48 Light precip.  
18:41:35 METRO: Slow field mills.  
18:42:11 Nothing going on, just smooth cloud - now a little light precip.

18:42:53 (Event storm exit.)  
18:43:15 (Data off.)  
18:43:20 Completed that one.

## AIS Record 6 - Penetration 4.

18:47:30 (Data on.)  
18:47:38 Data on for penetration 4, 15,000 ft.  
18:47:44 (Event - storm entry.)  
18:47:47 We're in the cloud.  
18:47:57 Some heavy precip now.  
18:48:04 And it ended.  
18:48:07 METRO: Getting some high frequency field mills now.  
18:48:27 We're out. (Event - storm exit.)

## AIS Record 7 - Penetration 5.

18:53:10 (Data on.)  
18:53:13 Data on for penetration 5. Heading 040°, altitude 15,000 ft.  
18:53:26 (Event-storm entry.)  
18:53:25 0° tilt.  
18:53:34 We are in the cloud.  
18:53:43 Light precip.  
18:53:58 Moderate precip.  
18:54:05 Now nothing - or real light precip.  
18:54:21 (Event - storm exit.)  
18:54:22 Breakout. End of that one.  
18:54:27 (Data off.)

## AIS Record 8 - Penetration 6.

18:58:10 (Data on.)  
18:58:11 Data on for penetration 6. Altitude 15,000 ft.  
18:58:21 (Event - storm entry.)  
18:58:25 In the cloud. Heading 220°.  
18:58:29 Good strike, to the nose!  
18:58:31 METRO: We got triggers.  
And you got the camera too.  
18:59:15 (Event - 1st cell exit.)  
18:59:57 (Event - 2nd cell entry.)  
18:59:58 Entered it. Light precip.  
19:00:07 Heading 220°.  
19:00:13 (Event - storm exit.)  
19:00:54 (Data off.)

## AIS Record 9 - Penetration 7.

19:02:50 (Data on.)  
19:02:58 Data on penetration 7. 040°, 15,000 ft.  
19:03:16 Very smooth ride. Nothing going on.  
19:03:25 (Event - storm exit.)



19:03:27 We are out.  
19:03:29 (Data off.)  
19:05:12 See that streak, I think it came when we got that strike.  
I think it got darker.  
(More comments about marks.)  
19:06:00 Weapons bay temperature pegged on bottom.  
(Radar scan.)

## AIS Record 10 - Penetration 8.

19:08:40 (Data on.)  
19:08:45 (Event- storm entry.)  
19:08:49 Back in the cloud with data on for penetration 8.  
19:09:04 Heading 220°, 15,000 ft.  
19:09:19 Light precip.  
19:09:40 Light precip and light turbulence.  
19:10:02 Moderate precip now.  
19:10:20 (Event - 1st cell exit.)  
19:10:37 (Event - 2nd cell entry.)  
19:11:10 Moderate precip.  
19:11:17 SPANDAR: Occasional level 5, 210°, 20 miles.  
19:11:26 (Event - 2nd cell exit.)  
(Radar scan.)  
19:12:31 (Event - 3rd cell entry.)  
19:12:50 Light precip.  
19:12:57 Flashes.  
19:13:00 Clicks in headset.  
19:13:12 Moderate precip.  
19:13:28 Now heavier precip and a little light turbulence.  
19:13:38 Updraft.  
19:13:57 (Event - storm exit.)  
19:14:00 (Data off.)  
19:14:02 We're out data off.  
19:16:38 SPANDAR: We show small area level 5, 040°, 5 miles ahead.

## AIS Record 11 - Penetration 9.

19:16:45 In heavy precip now.  
19:16:49 Data is on for penetration 9.  
19:16:50 (Data on.)  
19:17:04 A little moderate turbulence now.  
19:17:14 Precip continues at about moderate.  
19:17:16 Now gone to light.  
19:17:40 (Event - 1st cell exit.)  
19:18:30 SPANDAR: 030°, 4 miles, level 5.  
035°, 5 miles, level 5.  
19:18:44 (Event - 2nd cell entry.)  
19:18:59 Heavy precip.  
19:19:23 Now down to light precip.  
19:20:40 Getting heavy precip again.  
19:20:55 Updraft.

19:21:34 (Event - storm exit.)  
19:21:38 We're out.  
19:21:40 (Data off.)  
19:24:46 SPANDAR: 20 & 15 miles, level 5.

## AIS Record 12 - Penetration 10.

19:25:10 (Event - storm entry.)  
19:25:13 Data is on. We're back in for penetration 10.  
19:25:20 (Data on.)  
19:25:32 Heavy precip.  
19:25:41 Precip dropped off to light.  
19:25:57 Heavy precip.  
19:27:07 SPANDAR: 3 miles, level 5.  
19:27:21 Heavy precip now.  
19:27:28 Big updraft.  
19:27:31 Some turbulence.  
19:28:00 (Event - storm exit.)  
19:28:03 (Data off.)  
19:28:10 We're out in the clear. Data off.  
SPANDAR: 030°, 10 miles, level 5.

## AIS Record 13 - Penetration 11.

19:31:53 (Event - storm entry.)  
19:31:55 Data is on for penetration 11. We're in the cloud.  
19:32:00 (Data on.)  
19:32:05 I think I saw some flashes.  
19:32:14 Light precip. Now heavy precip.  
19:32:22 Flashes.  
19:32:26 METRO: Echo, flash no triggers.  
19:32:29 That was a bright flash.  
19:32:46 (Event - cell exit.)  
19:33:10 We're in 90-270. Data is still on. Picking up little cell in turn.  
19:33:40 We're in it. Heavy precip.  
19:33:43 Moderate turbulence.  
19:34:54 (Event - storm exit.)  
19:34:59 (Data off.)

## AIS Record 14 - Penetration 12.

19:35:51 Data is on for penetration 12. Altitude 15,000 ft.  
19:35:59 (Event - storm entry.)  
19:36:00 (Data on.)  
19:36:23 Light precip now.  
19:36:26 Flashes. Heavier precip now.  
19:36:44 Starting 90-270.  
19:38:26 (Event - storm exit.)  
19:38:27 (Data off.)  
19:40:08 Click in headset.

## AIS Record 15 - Penetration 13.

19:40:09 (Event - storm entry.)  
19:40:12 Back in for penetration 13.  
19:40:19 Heading 040°, altitude 15,000 ft.  
19:40:24 In heavy precip.  
19:40:25 METRO: Good field mills.  
19:40:32 Moderate turbulence.  
19:41:03 SPANDAR: 045°, 3 miles, level 5.  
19:41:27 Heavy precip.  
19:41:29 Echo in front.  
19:41:49 Good bumps along here with moderate precip.  
19:42:30 (Event - storm exit.)  
19:42:32 We're out - end of that penetration.  
19:43:20 SPANDAR: We show what you are flying thru to be broken up,  
3 cells.  
19:43:34 Most active appears to be middle one.  
19:44:44 Echo in front.  
  
AIS Record 16, Penetration 14.  
  
19:45:07 (Event - storm entry.)  
19:45:09 We're back in, data on.  
19:45:14 Penetration 14.  
19:45:22 Heading 220°, altitude 15,000 ft.  
19:45:32 -2°.  
19:45:37 +2°.  
19:45:41.4 (All LeCrois triggered and cockpit video recorded the  
strike.)  
19:45:42 Good strike with triggers.  
19:45:50 Relatively quiet. I could just barely hear it.  
19:45:54 Had a number of small filaments coming off the burst center.  
19:46:02 We were in relatively smooth cloud. Light precip. No  
turbulence.  
19:47:04 Getting heavy precip again.  
19:47:07 Flashes.  
19:47:13 Good turbulence thru here.  
19:45:25 We're out. starting 90-270°.  
19:47:27 (Event - storm exit.)  
19:47:29 (METRO: What did it look like, where did it come from  
when you got hit.  
19:47:32 It looked like left hand side the nose, and there were  
sorta a burst center with a number of filaments coming off  
of it.  
  
AIS Record 17 - Penetration 15.  
  
19:48:10 (Event - storm entry.)  
19:48:23 We're in some clouds in the turn. I've got the  
data on.  
19:48:59 (Event - storm exit.)  
19:49:33 I'll call the last one penetration 15.  
  
AIS Record 18 - Penetration 16.

19:49:50 (Event - storm entry.)  
19:49:51 SPANDAR: 050°, 5 miles.  
          050°, 10 miles, level 5.  
19:49:58 We're in heavy precip now.  
19:50:20 Distant flashes.  
19:50:31 Penetration 16.  
19:50:47 Heavy precip.  
19:51:12 That's about it.  
19:51:42 Keeping data on. (Some cloud in front of them.)  
19:52:41 (Event - storm exit.)

AIS Record 19 - Landing.

20:01:10 (AIS data on.)  
20:02:08 (Touchdown.)  
20:03:00 (AIS data off.)

AIS Record 20 - Chocks.

20:06:50 (AIS data on.)  
20:07:53 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-046 F-106B

Date August 12, 1984

Crew Brown/Winebarger

Engine Start 18:17:20

Take-off 18:25:56

Landing 20:02:08

## Lightning Systems:

Dlite 2 Triggers

40ns LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{B}_L$  3  $\dot{I}$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

5ns LeCroy IV.1 TP100 2 TP101 3 TP 123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver NU

Aft movie camera INOP. Jammed

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 2 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Minor damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Chambers Field,

Norfolk, VA

Pens 16

Strikes 2

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 046

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR OKUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OKLaRC OKELF Antenna NILLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-047, August 13, 1984

Storm Flight/Sunns Intersection on  
Navigation Charts, NC

Brown/Fisher

GMT

19:12:37 (Engine start.)  
19:14:00 (DLite Master power on.)

AIS record 2 - Takeoff.

19:21:20 (AIS data on.)  
19:21:43 (Takeoff.)  
19:22:24 (AIS data off.)  
  
19:28:30 (DLite instrumentation on.)  
(2 sets of DLite calcs.)  
19:29:18 (Voice recorder on.)  
19:29:29 (Radar video recorder on. Cockpit video camera on, also.)  
19:32:02 Bring data on here.

AIS record 3 - Pen #1.

19:32:18 SPANDAR: 200°, 10 miles, level 5  
(Radar scan)  
19:32:20 (AIS & DLite data on. Time code stable.)  
19:32:35 Data came on at cloud entry for penetration  
FL 200, heading 200°.  
19:32:45 Calm and dry at this time.  
19:33:17 SPANDAR: We show level 5 dead ahead, 5 miles  
19:33:37 Light turbulence.  
19:33:40 Nearby flashes ahead.  
19:34:00 Conditions unchanged.  
19:34:07 Nearby flash overhead.  
19:34:25 Cloud exit, event. (Event.)  
19:34:31 Data systems off.  
19:34:32 (AIS & DLite data off.)

AIS record 4- Pen #2

19:37:30 (AIS & DLite data on.)  
19:37:35 Nearby flash.  
19:37:44 (Event for cloud entry.)  
19:37:45 Cloud entry, event.  
19:37:53 Data on, penetration #2, FL200, heading 300°.  
19:38:06 (DLite LeCroy crates 1-4 and cockpit video record a direct  
strike. External camera automatically triggers.)  
19:38:07 Wow!  
19:38:08 Good - 2 strikes.

19:38:09 2 direct strikes to aircraft in succession to the nose boom.  
All triggers.  
19:38:14 That was impressive.  
19:38:17 2 in a row.  
19:38:20 I heard a boom with both.  
Muffled.  
19:38:25 (External camera triggers automatically.)  
19:38:27 2 strikes, calm and dry, and we are just seeing the first rain  
in this penetration  
19:38:31 Light rain.  
19:38:32 Going to light to moderate turbulence.  
19:38:46 Now in moderate rain.  
19:38:48 Light turbulence.  
19:38:53.2 (DLite LeCroy crates 1-4 trigger.)  
19:38:57 Moderate turbulence bump.  
19:38:59 In moderate turbulence.  
19:39:00 Light to moderate rain.  
19:39:01 Nearby flashes.  
19:39:28 Trigger light #4 not functioning in the cockpit.  
19:39:43 Heavy rain.  
19:39:44 Light to moderate turbulence.  
19:39:54 Weapons bay temperature 70°.  
19:40:16 Rain has just fallen off to light. Turbulence is light.  
19:40:36 Cloud exit, event. (Event.)  
19:40:45 (AIS & DLite data off.)  
  
19:40:46 Data off.  
  
AIS record 5 - Pen #3.  
  
19:41:46 Data on.  
19:41:50 19,000 ft.  
19:41:55 Data on for penetration 3. 19,000 ft.  
19:42:00 (AIS & DLite data on. Time code stable.)  
19:42:05 Event for cloud entry. (Event.)  
19:42:15 Light rain and light turbulence.  
19:42:34 Cloud exit, event.  
19:42:35 (Event for cloud exit.)  
19:42:41 Data off. (AIS & DLite data off.)  
  
AIS record 6 - Pen #4  
  
19:43:05 Data on.  
19:43:20 Cloud entry event. (AIS & DLite data on. Time code stable.  
Event.)  
19:43:25 Penetration #4. FL190, currently at 140°.  
19:43:37 Cloud exit - right.  
19:43:43 Cloud exit - left.  
19:44:27 In light rain and light turbulence.  
19:44:38 Moderate rain and light turbulence.  
19:44:46 Good vertical development through here.  
19:44:51 Moderate rain and moderate turbulence.  
19:45:13 Moderate rain and light to moderate turbulence. Getting darker.  
19:45:28 Updraft.



19:45:31 Nearby flashes.  
19:46:05 (External camera triggers automatically.)  
19:46:06 Very close flashes.  
19:47:07 Cloud exit, event. (Event.)  
19:47:12 Data off. (AIS & DLite data off.)

## AIS record 7 - Pen #5.

19:48:35 Data on, (at cloud entry.)  
19:48:40 (AIS & DLite data on. Time code stable.)  
19:48:42 Penetration #5, FL180, heading 290°.  
19:48:50 Nearby flashes ahead.  
19:49:05 Very light rain and light turbulence. (Radar scan.)  
19:49:40 Conditions unchanged.  
19:50:05.5 (DLite LeCroy crates 1-4 & video camera record a strike.  
External camera triggers automatically.)  
19:50:07 Nice one!  
19:50:08 Again, lightning strike to aircraft with a lot of persistence.  
19:50:11 We have all triggers.  
19:50:13 A nice sharp clunk with that one.  
19:50:15 That was a big strike.  
19:50:22 I saw it on right side, may be prospective problem.  
19:50:25 I saw it on left side.  
19:50:29 In light rain and light turbulence at the time.  
19:50:32 Now in light to moderate rain.  
19:50:34 Light to moderate turbulence.  
19:50:53 (External camera triggers automatically.)  
19:50:54 Nearby flash.  
19:50:55 Another nearby flash ahead.  
19:51:06 Light to moderate rain.  
19:51:07 Light to moderate turbulence.  
19:51:13 Steady moderate rain, Moderate turbulence.  
19:51:22 Updraft, slight.  
19:51:32 Now in moderate rain.  
19:51:33 Light to moderate turbulence.  
19:51:35 Now steady moderate turbulence.  
19:51:55 Cloud exit, event. (Event.)  
19:52:00 Data off.  
19:52:07 (AIS & DLite data off.)

## AIS record 8 - Cloud record.

19:52:19 Data on. Fringe of clouds.  
19:52:27 Penetration #6. FL180°. Still in turn.  
19:52:30 (AIS & DLite data on. Time code stable.)  
19:52:40 (AIS & DLite data off.)  
  
19:52:43 Data off. In fringe of cloud. Will not call that  
penetration. Cloud record.

## AIS record 9 - Pen #6

19:53:43 Data on.  
19:53:48 Cloud entry, event. (Event.)

19:54:00 (AIS & DLite data on. Time code stable.)  
19:54:11 Penetration #6, FL 17,000 ft, heading 120°. (Radar scan.)  
19:54:38 Moderate rain.  
19:54:39 Light to moderate turbulence.  
19:54:58 Moderate rain, light to moderate turbulence.  
19:55:04 Heavy rain, light to moderate turbulence.  
19:55:09 Rain falls off to moderate.  
19:55:30 Light to moderate turbulence, light to moderate rain.  
19:55:33 Updraft.  
19:55:51 Heavy rain. Light to moderate turbulence.  
19:56:08 I'd say moderate rain, for sure.  
19:56:10 Moderate rain.  
19:56:11 Nearby flashes.  
19:56:12 Light to moderate turbulence.  
19:56:16 Heavy turbulent bump.  
19:56:55 Cloud exit, event.  
19:56:56 (Event for cloud exit.)  
19:57:02 Data off.  
19:57:03 (AIS & DLite data off.)  
  
19:57:27 Fuel balance looks good.  
  
AIS record 10 - Pen #7.  
  
19:58:40 Data on. (AIS & DLite data on.)  
19:58:45 Penetration #7.  
19:59:04 Level at 17,000 ft, heading 300°. (Radar scan.)  
19:59:07 Light rain, light to moderate turbulence. (at 15,000 ft between cells)  
  
19:59:47 Cloud entry, event. (Event.)  
19:59:52 Nearby flashes.  
19:59:54 Light to moderate rain, light to moderate turbulence.  
20:00:20 (External camera triggers automatically.)  
20:00:21 (External camera triggers automatically.)  
20:00:26 Had some channels go right down the left side of airplane without attaching to us.  
  
20:00:59 Nearby flash.  
20:01:04 Light to moderate rain, light to moderate turbulence.  
20:01:07 Steady moderate rain.  
20:01:22 Moderate to heavy rain, still light to moderate turbulence.  
20:01:33 Rain rate staying with us.  
20:01:41 Updraft.  
20:02:20 In continuous moderate rain and light to moderate turbulence.  
20:02:32 Heavy rain, moderate turbulence.  
20:02:45 In second cloud mass.  
20:02:49 Light to moderate rain rate, light to moderate turbulence.  
20:03:03 Excellent vertical development through here.  
20:03:06 Continuous moderate to heavy rain.  
20:03:18 Rain is off to light.  
20:03:20 Cloud exit.  
20:03:21 (Event for cloud exit.)  
20:03:28 Pretty clouds today.

20:03:29 (AIS & DLite data off.)  
20:03:30 Data off.  
AIS record 11 - Pen #8.  
20:05:38 Data on.  
20:05:47 Penetration #8: 15,000 ft, 120°.  
20:05:50 (AIS & DLite data on. Time code stable.)  
20:06:02 (Event for cloud entry.)  
20:06:03 Cloud entry. WOW!  
20:06:07 Immediate heavy rain and moderate turbulence.  
20:06:13 Excellent updraft.  
20:06:21 Very heavy rain, light to moderate turbulence.  
(Radar scan.)  
20:07:06 Moderate rain, still light to moderate turbulence.  
20:07:31 Moderate rain, moderate turbulence.  
20:07:41 Heavy rain, light to moderate turbulence.  
20:07:58 Conditions unchanged.  
20:08:06 Moderate turbulence.  
20:08:18 Rain is off to light, turbulence is light to moderate.  
20:08:31 Very dark through here.  
20:08:41 Moderate rain, moderate turbulence.  
20:09:01 (External camera triggers automatically.)  
20:09:02 Very close flashes ahead.  
20:09:04 METRO: Camera flash.  
20:09:28 Cloud exit, event. (Event.)  
20:09:31 (AIS & DLite data off.)  
20:09:32 Data off.  
20:09:56 About 40 miles out.  
20:11:37 METRO: Data on.  
20:11:40 You got it.  
AIS record 12 - Pen #9.  
20:11:44 Penetration #9, 15,000 ft, 315°.  
(Radar scan.)  
20:11:50 (AIS & DLite data on. Time code stable.)  
20:12:30 Cloud entry, event. (Event.)  
20:12:36 Good strike.  
20:12:36.1 (DLite LeCroy crates 1-4 & cockpit video record a strike.  
External camera triggers automatically.)  
20:12:39 With triggers.  
20:12:41 Light rain, light turbulence.  
20:13:01 Moderate turbulence, still light rain.  
Now light turbulence. Still light rain.  
Now light turbulence.  
(Radar scan.)  
20:13:52 Light rain, light turbulence.  
20:14:11 Moderate rain, light turbulence.  
20:14:23 Pilot calling this heavy rain. Still light turbulence.  
20:14:50 Flashes to left.  
20:15:01 Heavy rain, light to moderate turbulence.

20:15:29 Moderate rain, moderate turbulence.  
20:15:37 Heavy rain, light to moderate turbulence.  
20:15:43 SPANDAR: On western edge of front, small amount level 5.  
20:16:00 METRO: We show something looks like Corona.  
20:16:04 We can't see through windscreen because of rain, it is real bright.  
20:16:10 (Event for cloud exit.)  
20:16:11 Cloud exit.  
20:16:16 (AIS & DLite data off.)  
  
20:16:17 Data off.  
20:16:55 DLite digital counter is not working.  
  
AIS record 13 - Pen #10.  
  
20:18:24 Data on  
20:18:26 Penetration #10, 15,000 ft, 110°.  
20:18:35 SPANDAR: 135°, level 5, 2 to 3 miles, very small.  
20:18:40 (AIS & DLite data on. Time code stable.)  
20:18:42 Cloud entry.  
20:18:43 (Event for cloud entry.)  
20:18:48 Moderate rain, moderate turbulence.  
20:18:55 Heavy rain.  
20:18:56 Very heavy rain momentarily.  
20:18:58 Dropped back to heavy.  
20:19:00 Light to moderate turbulence.  
20:19:43 Light rain, light turbulence.  
20:19:44 (External camera triggers automatically.)  
20:19:46 Nearby flash.  
20:20:01 Close flashes on the left.  
20:20:11 Occasional light rain, moderate turbulence.  
20:20:15 Moderate rain, light to moderate turbulence.  
20:20:00 (External camera triggers automatically.)  
20:20:27 Updraft.  
20:20:39 Conditions unchanged.  
20:21:01 Light rain, light turbulence.  
20:21:44 Keeping data on in turn, 90° - 270° because we're in the clouds.  
20:22:24 Cycled MARS (Turned DLite tape recorder switch on and off.)  
20:22:46 Cloud exit, event. (Event.)  
20:22:58 (AIS & DLite data off.)  
  
20:22:59 Data off.  
20:23:52 Intercloud flash ahead.  
20:24:55 Cycle instrumentation switch. (Turn DLite instrumentation switch on and off.)  
(Radar scan.)  
  
AIS record 14 - Pen #11.  
  
20:24:59 Data on.  
20:24:59 Penetration #11. - 15,000 ft.  
20:25:00 (AIS & DLite data on. Time code stable.)  
20:25:15 Cloud entry, but no event. (Cloud entry.)  
20:25:29 Light turbulence, light rain.

20:25:44 Flashes overhead.  
20:26:03 Occasional moderate turbulence, light rain.  
20:26:23 Updraft.  
20:26:31 Moderate rain, light to moderate turbulence.  
20:26:50 SPANDAR: 290°, 7 miles, level 5.  
20:26:52 (External camera triggers automatically.)  
20:26:54 Nearby flash.  
20:27:02 Light to moderate turbulence, occasionally, light rain.  
(Radar scan.)  
20:27:20 Moderate rain, light to moderate turbulence.  
20:27:32 Light to moderate turbulence, heavy rain.  
20:27:45 SPANDAR: 270°, 4 miles: level 5.  
20:27:57 Although it is extremely bright, we are in heavy rain. Light to moderate turbulence.  
(Event for cloud exit.)  
20:28:12 Cloud exit, event.  
20:28:13 (AIS & DLite data off.) (Cycle DLite Master power switch off  
20:28:16 and on. Power transient shuts Radar video recorder off.)

## AIS record 15 - Pen #12.

20:29:56 Data on.  
20:30:10 (AIS & DLite data on. Time code stable.  
20:30:04 Penetration 12.  
20:30:07 Moderate turbulence, moderate rain.  
20:30:24 Cloud entry, main mass. (Cloud) (Event.)  
20:30:29 Digital counter is running.  
20:31:40 Moderate rain, light turbulence.  
20:31:47 Nearby flash on left.  
20:31:53 Moderate turbulence, light rain.  
20:32:00 Moderate rain, moderate turbulence.  
20:32:10 Rain is off to light.  
20:32:12 Turbulence light to moderate.  
20:32:47 Partial breakout on right.  
20:33:01 Nearby flash.  
20:33:04 Light to moderate turbulence, light rain.  
20:34:03 Cloud exit, event. (Event.)  
20:34:07 Data off.  
20:34:07 (AIS & DLite data off.)

20:35:30 METRO: Data on.  
20:35:33 Get it.

## AIS record 16 - Pen #13.

20:35:36 Penetration 13, 15,000 ft, heading 300°.  
20:35:40 (AIS & DLite data on. Time code stable.)  
(Radar scan.)  
20:36:10 Cloud entry, event. (Event.)  
20:36:18 Light rain.  
20:36:19 No turbulence.  
20:36:56 Nearby flashes ahead.  
20:37:28 Occasional light turbulence and occasional light rain.  
20:37:34 Smoothest ride we've had.

20:37:43 Now in continuous light rain, light turbulence.  
20:37:52 Updrafts.  
20:37:59 Continuous moderate rain, light to moderate turbulence  
20:38:02 Getting much brighter.  
20:38:03 Nearby flash.  
20:38:08 Excellent updraft.  
20:38:24 Breakout above to right.  
20:38:29 Moderate turbulence, moderate rain.  
20:38:34 Breakout left, then back in.  
20:38:49 Heavy rain, moderate turbulence.  
20:39:00 Momentary cloud exit. (Event.)  
20:39:28 Cloud entry. (Event.)  
20:39:34 Reentry. Moderate rain. Light to moderate turbulence.  
20:39:44 Cloud exit. (Event.)  
20:39:53 Data off. (AIS & DLite data off.)

(AIS record 17 - DLite calcs.).

20:41:30 (AIS & DLite data on.)  
(2 sets of DLite calcs.)  
20:42:50 (AIS & DLite data off.)  
  
20:44:45 (DLite instrumentation off.)  
20:45:10 (Voice recorder off.)

AIS record 18 - Landing.

20:48:50 (AIS data on.)  
20:49:50 (Landing.)  
20:50:46 (AIS data off.)

AIS record 19 - chocks.

20:56:20 (AIS data on.)  
20:56:50 (AIS data off.)

(DLite master power and radar video off at engine shutdown.  
Cockpit video camera off with radar video.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-047 F-106B

Date August 13, 1984

Crew Brown/Fisher

Engine Start 19 :12 :37

Take-off 19 :21 :43

Landing 20 :49 :50

## Lightning Systems:

Dlite 4 Triggers\*\*

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{B}_L$  3  $\dot{I}$

10ns LeCroy III.1  $\dot{D}_F$  2  $\dot{D}_{W,L}$  3 INOP

5ns LeCroy IV.1 TP100 2 TP101 3 NI

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{D}_F=X$

\*\* TR4 wouldn't light and counter  
wouldn't run until DL Master  
recycled.

Aft movie camera 3 Strikes. Auto. 400 pps.

Cockpit cameras \_\_\_\_\_

Stereo Fwd NI

Hass aft NI

Aft video 3 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP

Passive protection \_\_\_\_\_

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK\*\*\*

Voice Poor Quality

Kavouris Radar

Receiver OK

\*\*\* (Turned off by power  
cycle)

Region Sunns Intersection

in NC

Pens 13

Strikes 5

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84-047

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR PINOPUHF Radar OKC-Band Tracking OKGoddard Antennas OKGSFC NUWFF OK - Too farLaRC NUELF Antenna NILLP OKWFF Plots OKLaRC Plots OKWFF Tape OK



Debrief Notes for Flight 84-048, August 14, 1984

Storm Flight/Tappahanock, VA.

Brown/Winebarger

GMT

AIS Record 1 - Video check.

18:07:20 (AIS data on.)  
18:08:02 (AIS data off.)  
18:38:08 (Engine start.)

AIS Record 2 - Takeoff.

18:50:40 (AIS data on.)  
18:50:50 (Liftoff.)  
18:51:31 (AIS data off.)

AIS Record 3 - Penetration 1.

18:59:17 Data is on for penetration 1, turning to right to 90°, altitude  
22,000 ft.  
18:59:25 In the clouds.  
18:59:27 (Event - storm entry.)  
18:59:30 (Data on.)  
18:59:38 Flashes.  
18:59:52 More flashes.  
18:59:56 Precipitation and light turbulence.  
19:00:16 Distant flashes.  
19:07:31 Light precipitation.  
19:00:34 Good bounce.  
19:00:46 (Event - storm exit.)  
19:01:12 In thin clouds.  
19:02:27 (Data off.)

AIS Record 4 - Penetration 2.

19:03:29 (Storm entry.)  
19:03:30 (Data on.)  
19:03:44 Distant flashes.)  
19:03:51 More flashes, light precipitation.  
19:04:04 Penetration 2, 85°, altitude 22,000.  
19:04:36 (Event - Storm exit.)  
19:04:43 End penetration. Starting turn.  
19:04:44 (Data off.)

AIS Record 5 - Penetration 3.

19:06:40 (Data on and storm entry.)  
19:06:48 Flashes.  
19:07:24 Lots of distant flashes.

19:07:30 Penetration 3, heading 265°, altitude 22,000.  
19:07:40 Smooth ride.  
19:07:41 In the cloud.  
19:07:42 Distant flashes.  
19:07:50 Can't see any precipitation.  
19:07:52 Occasional light.  
19:07:54 More distant flashes.  
19:08:03 Now a little visible precipitation.  
19:08:08 Moderate precipitation.  
19:08:10 Updraft.  
19:08:42 (Event - storm exit.)  
19:08:44 (Data off.)

## AIS Record 6 - Penetration 4.

19:09:45 Data back on.  
19:09:50 (Data on.)  
19:10:24 Back in the storm.  
19:10:25 Penetration 4, heading east, 20,000.  
19:10:39 Moderate precipitation.  
19:10:42 Distant flashes.  
19:11:00 Bright flashes.  
19:11:07 Light turbulence, light precipitation.  
19:11:12 Bright flashes.  
19:11:54 (Event storm exit.)  
19:11:56 (Data off.)

## AIS Record 7 - Penetration 5.

19:13:34 Data on for penetration 5. Coming around to westerly heading.  
Altitude - climbing through 22,600 to 23,000.  
19:13:40 (Data on.)  
19:14:22 (Event - Storm entry.)  
19:14:30 SPANDAR: 270° at 10 miles level 5.  
19:14:59 Distant flashes.  
19:15:06 Now some red showing ahead. We'll pass to the north of it.  
19:15:13 Light precipitation.  
19:15:17 Lots of flashes.  
19:15:21 Moderate turbulence, bright flash.  
19:16:05 (Event - storm exit.)  
19:16:09 METRO: We've had 5 millikans.  
19:16:37 (Data off.)  
19:17:44 Fuel balance looks o.k.  
19:18:04 SPANDAR: Small area of level 6, 100°, 15 miles.  
19:18:20 SPANDAR: Now down to level 5.

## AIS Record 8 Penetration 6.

19:18:24 (Event - Storm event.)  
19:18:40 (Data on.)  
19:18:46 Data on. Penetration 6. Moving to south to let red drift to left.  
19:19:12 SPANDAR: It has upgraded to level 6, about 7 miles from you.  
19:19:20 (Radar scan.)

19:19:29 We are headed east altitude 23.  
19:19:45 Updraft.  
19:19:47 Moderate turbulence, light precipitation.  
19:19:57 Distant flashes.  
19:19:59 Updraft.  
19:20:01 Strike.  
19:20:02 (Aft camera and cockpit video recorded the strike.)  
19:20:04 Sounded like 2.  
19:20:06 That one took the DLite tape recorder with it.  
19:20:13 Fairly low level noise. Sounded like 2 noises.  
19:20:25 Is that unusual? (DLite shut down.)  
19:20:27 Yes.  
19:20:29 Came back on when recycled.  
19:21:02 (Event - storm exit.)  
19:21:08 (Data off.)  
19:21:32 Tape recorder light went off with trigger light.  
19:21:49 Light precipitation and moderate turbulence at time of the strike.  
19:22:33 30 miles east of Richmond.

## AIS Record 9 - Penetration 7.

19:23:08 Data on, penetration 7, heading west, altitude 23,000.  
19:23:15 In the light part of the cloud.  
19:23:20 (Data on.)  
19:23:29 SPANDAR: 30°, 10 miles, level 5.  
19:23:32 We see very little yellow.  
19:23:57 0° tilt.  
19:24:02 Moderate turbulence, light precipitation, distant flashes.  
19:24:16 More distant flashes and more.  
19:25:24 We have not come out of the cloud so we are leaving data on.  
19:26:33 SPANDAR: You have level 5, 100°, 10 miles.  
19:26:41 (Data off.)

## AIS Record 10 - Penetration 8.

19:27:00 (Data on.)  
19:27:04 Recycle data for penetration 8. Heading east, altitude 23,000.  
19:27:28 Distant flashes, no precipitation, light turbulence.  
19:27:32 Now light precipitation.  
19:27:43 Distant flashes, light precipitation, moderate turbulence.  
19:27:48 Lots of close flashes.  
19:28:00 More flashes.  
19:28:37 Still in cloud with data on.  
19:28:44 Just had a flash.  
19:28:51 Lightning all over up here.  
19:28:53 I know it but it isn't hitting us though.  
19:30:12 (Data off.)  
19:30:44 METRO: (Try to get 20,000.)

## AIS Record 11 - Penetration 9.

19:30:50 (Data on.)  
19:31:17 Heading 270°, altitude 23,000 for penetration 9.

19:31:45 Wow we!  
19:31:46 What in the world was that?  
19:31:49 We had a bolt that went parallel with us on the right side for a good while.  
19:31:54 It liked like it was moving both ways the way it was sparking. Looked like it was kinda oscillating back and forth...channel. Didn't trigger anything though, did it?  
19:31:05 Negative.  
19:32:14.2 (All LeCroys triggered. Indicated a strike.)  
19:32:19 We just got triggers. I don't know form what.  
19:33:02 We are in the 90°-270°.  
19:33:24 Distant flashes.  
19:33:48 How long do you think that thing lasted? It seemed like an awful long time. It must have been around...at least a second, don't you think?  
19:33:53 Yeah, at least a second.  
19:34:26 (Data off.)

## AIS Record 12 - Penetration 10.

19:34:57 Heading 090°, 20,000 for penetration 10.  
19:35:00 (Data on.)  
19:35:12 In the storm. Light turbulence.  
19:35:16 Distant flashes.  
19:36:03 Distant flashes, light turbulence, negligible precipitation.  
19:36:17 More flashes.  
19:36:24 Starting 90-270°.  
19:36:35 In cloud with data on.  
19:36:51 Hey!  
19:36:51.2 (All LeCroy triggered, aft camera and cockpit video recorded the strike.)  
19:36:52 Strike with triggers!  
19:36:54 Strike. A couple of channels. I saw one high, one at about 1 o'clock and one at about 3 o'clock around the fuselage.  
19:37:10 For some reason I'm seeing things more clearly today then I frequently do. I don't know if it's the way the stuff moves along the channels or what. Better defined? Seemed to be moving slower, persisting longer, or something.  
19:37:45 We were just in smooth cloud with nothing going on with that strike.  
19:38:44 (Data off.)

## AIS Record 13 - Penetration 11.

19:39:08 Data is recycled for penetration 11. Heading west. Altitude 19,700.  
19:39:10 (Data on.)  
19:39:23 Some moderate turbulence and moderate precipitation now.  
19:39:41 Lots of flashes.  
19:40:00 Flashes.  
19:40:08 METRO: Next penetration we would like you at 18,000.  
19:40:31 Starting 90°-270°.  
19:41:34 Check fuel balance again.  
19:41:46 (Data off.)

## AIS Record 14 - Penetration 12.

19:42:50 (Data on.)  
19:42:56 SPANDAR: 100°, 15 miles, level 5.  
(Radar scan)  
19:43:35 Lots of flashes, smooth ride, no precipitation.  
19:43:48 In penetration 12. Descending to 18.  
19:44:04 Heading 090°.  
19:44:19 A few flashes along there.  
19:44:45 Light precipitation, moderate turbulence.  
19:44:56 Distant flashes.  
19:45:10 (Event - Storm exit.)  
19:45:11 We just broke out.  
19:45:13 (Data off.)  
19:45:17 See flashes at 11 o'clock.

## AIS Record 15 - Penetration 13.

19:46:58 Back in, penetration 13, moderate precipitation, moderate turbulence, heading 270°, altitude 18,000.  
19:47:00 (Data on.)  
19:47:09 Heavier precipitation now, some distant flashes.  
19:47:41 No precipitation now, negligible turbulence.  
19:47:46 Light precipitation.  
19:47:50 Distant flash.  
19:47:59 Flashes.  
19:48:12 Starting 90°-270° to right.  
19:48:34.1 (All LeCroy's triggered, aft camera and cockpit video recorded strike.)  
19:48:39 Strike!  
19:48:40 With triggers.  
19:48:42 Moderately loud, just to left of nose.  
19:48:46 All in smooth cloud again.  
19:48:50 No noticeable precipitation.  
19:50:15 (Data off.)

## AIS Record 16 - Penetration 14.

19:50:30 (Data on.)  
19:50:41 Penetration 14, heading 85°. Altitude 18,000.  
19:51:29 Light precipitation, light turbulence, distant flash.  
19:51:36 Moderate turbulence, moderate precipitation.  
19:51:50 Updraft.  
19:51:51 Good bounce.  
19:52:00 Starting 90°-270° to left.  
19:52:04 Flashes!  
19:53:17 (Event - storm exit)  
19:53:21 (Data off.)

## AIS Record 17 - Penetration 15.

19:54:10 (Data on.)  
19:54:48 Heading 260°, altitude 18,000, penetration 15.

19:54:54 SPANDAR: Small area 270°, 3 miles.  
19:54:58 Moderate precipitation, heavier precipitation, light turbulence.  
19:55:30 Starting 90°-270°.  
19:55:38 (Event - Storm exit but still in thin clouds.)  
19:55:54 In real thin clouds and I just saw a flash there.  
19:57:08 (Data off.)

## AIS Record 18 - Penetration 16.

19:59:30 (Data on.)  
19:59:50 Heading 090°, altitude 21,000, penetration 16.  
20:00:00 In the cloud but good ways to contour.  
20:00:41 Getting some moderate turbulence now and light precipitation.  
20:00:49 Distant flashes.  
20:00:55 Updraft.  
20:02:08 Starting 90°-270°.  
20:02:58 Distant flash.  
20:03:05 What does field mill look like in this thin cloud?  
20:03:12 METRO: Looks good enough to keep data on?  
20:03:36.2 (All LeCroys triggered - nearby.)  
20:03:45 (Data off.)  
20:03:58 METRO: LeCroys triggered.  
20:04:00 I see that - but didn't see anything to do it.

## AIS Record 19 - Penetration 17.

20:04:09 Now we are getting flashes.  
20:04:10 (Data on.)  
20:04:13 Precipitation and moderate turbulence.  
20:04:22 Penetration 17, at 21,000, headed 270°.  
20:04:44 Starting 90°-270°.  
20:05:06 (Event - Storm exit.)  
20:05:11 (Data off.)

## AIS Record 20 - Penetration 18.

20:06:20 (Data on.)  
20:06:55 Flashes and we're headed 085°, altitude 19,000, penetration 19.  
20:07:24 Some moderate turbulence, negligible precipitation.  
20:07:28.9 (All LeCroys triggered and cockpit video recorded the strike.)  
20:07:30 Strike! Nice loud one.  
20:07:32 A loud boom with that one.  
20:07:39 Now we are getting moderate precipitation.  
20:07:47 Good bounce.  
20:07:58 Precipitation has quit.  
20:08:17 (Event - Storm exit.)  
20:08:50 (DLite calcs.)  
20:09:31 (Data off.)

## AIS Record 21 - Landing.

20:16:20 (AIS data on.)  
(Touchdown.)  
20:17:20 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84- 048 F-106B

Date August 14, 1984

Crew Brown/Winebarger

Engine Start 18:38:08

Take-off 18:50:50

Landing 20:25:17

## Lightning Systems:

Dlite 5 Triggers\*

40ns LeCroy I.1  $\overset{\cdot}{\underset{\cdot}{D}}_F$  2  $\overset{\cdot}{\underset{\cdot}{I}}_N$  3  $\overset{\cdot}{\underset{\cdot}{I}}_T$

10ns LeCroy II.1  $\overset{\cdot}{\underset{\cdot}{D}}_T$  2  $\overset{\cdot}{\underset{\cdot}{B}}_L$  3  $\overset{\cdot}{\underset{\cdot}{I}}$

10ns LeCroy III.1  $\overset{\cdot}{\underset{\cdot}{D}}_{W,R}$  2  $\overset{\cdot}{\underset{\cdot}{D}}_{W,L}$  3  $\overset{\cdot}{\underset{\cdot}{D}}_F$

5ns LeCroy IV.1 TP100 2 TP101 3 INOP

Digital Peak Counter 1  $\overset{\cdot}{\underset{\cdot}{I}}=X$  2  $\overset{\cdot}{\underset{\cdot}{D}}_F = X$

\* Lost MARS w/1st strike.

## Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK - But poor quality.

Kavouris Radar

Receiver OK

Aft movie camera 3 Strikes. Auto. 400 pps.

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video 4 Strikes

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type KT/EP. Heavy cosmetic damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Tappahannock, VA

Pens 18

Strikes 5

Nearbys 1

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 048

## Ground-Based

### Metro

#### Telemetry

Strip Charts OK

PCM Data OK

#### Kavouris System

Basic Display OK

INS Overlay OK

Triggers OK

Videotape OK

Satellite Pictures OK

### Wallops

SPANDAR

Videotape OK

Digital dBZ Tape OK

LDAR OK

UHF Radar OK

C-Band Tracking OK

Goddard Antennas OK

GSFC NU - Too far

WFF OK - Too far

LaRC NU - Too far

ELF Antenna OK

LLP OK

WFF Plots OK

LaRC Plots OK

WFF Tape OK



Debrief Notes for Flight 84-049, August 23, 1984

Storm Flight/Dam Neck, VA

Neely/Rondeau

GMT

18:42:XX (Engine start.)

AIS Record 2 - Takeoff.

18:59:53 (Takeoff.)

10:00:00 (AIS data on. Time code stable.)

19:00:57 (AIS data off.)

AIS Record 3 - Pen #1.

19:09:10 (AIS & DLite data on.)

19:09:16 Data is on.

19:09:21 DLite tape is running.

19:09:25 Ready for our first penetration.

19:09:27 (Event Button.)

19:10:01 It is so pretty up here, you can't see anything.

19:11:50 19,000, heading 075°.

19:12:08 Just entered the cloud. Slight turbulence. Real bright. (Cloud entry.)

19:12:16 Some rain.

19:13:44 Cloud exit.

19:13:47 (AIS & DLite data off.)

19:13:53 Data off.

19:15:30 First Penetration was at 18,000 ft.

19:16:08 In the clouds now.

19:16:14 METRO: Bring data on. You're getting good field mills.

AID Record 4 - Pen #2.

19:16:22 Data is on.

19:16:30 (AIS & DLite data on. Time code is stable.)

19:16:31 (Event for cloud entry.)

19:16:39 Storm ahead has a little yellow, 2° down on tilt, 19,000 ft.

19:16:44 Storm is about 3 miles away.

19:16:56 Very slight turbulence.

19:17:12 Little precip just went across windscreen.

19:17:15 Slight precip. Altitude 19,000.

19:17:33 Out of the cloud. (Cloud exit.)

19:17:40 Data off.

19:20:44 Got 7,000 lbs gas.

19:20:57 METRO: Bring data on.

AIS Record 5 - Pen #3.

19:21:03 Data is on. (Master data switch on.)  
19:21:12 (Event for cloud entry.)  
19:21:20 (AIS & DLite data on. Time code stable.)  
19:21:25 In slight turbulence right now. There's nothing out here.  
METRO: Pen 3?  
Roger, Pen 3, when we get there.  
19:21:59 SPANDAR: Small area of level 5, dead ahead, 1 mile, about 045°.  
19:22:17 Slight turbulence.  
19:22:32 We just went thru a little bit of heavier precip, but still pretty light.  
19:22:51 060°, 18,500. I don't see anything.  
10:23:00 METRO: Interesting field mills. E<sub>y</sub> is almost full scale.  
All it is, is turbulence. (Keep data on.)  
19:23:20 Precip.  
19:23:25 METRO: Data on for a little more.  
19:25:10 I'm going to turn data off..  
19:25:12 (AIS & DLite data off. Cloud exit.)  
19:27:27 Look at this! Look at your radar.  
I don't have anything.  
19:27:36 I have an additional storm. Showed up on my scope here.  
19:29:38 METRO: Data on, quickly.

## AIS Record 6 - Pen #4.

19:29:50 (AIS & DLite data on. Cloud entry.)  
19:29:55 Stormscope is active.  
19:30:03.5 (DLite LeCroy triggers 1-3.)  
19:30:04 Ah, a strike!  
19:30:08 It was more like a discharge. It flew over from the airplane.  
19:30:18 It didn't look to me like a normal strike that we see.  
19:30:21 That was not exactly a strike. At the base of the pitot boom, I just happened to look at it, it was just a little glow that started there. Didn't see any strikes at all.  
19:30:34 METRO: It's a strike by our book.  
19:31:01 (Clear stormscope.)  
19:31:42 Did we get triggers?  
yep.  
19:31:54 That was in Pen 4.  
19:32:02 Precip.  
19:32:04 Slight precip.  
Bright sunshine.  
19:32:18 We're out in clear.  
19:32:21 Pretty strong downdraft, just then.  
19:32:54 Next penetration will be Pen 5.  
19:33:16 Moderate turbulence. We are not in storm yet.  
19:33:45 Moderate precip.

19:33:48 We're out. (Cloud exit.)  
19:33:52 (AIS & DLite data off.)  
19:33:55 Data off.  
19:35:30 METRO: Confirm position of camera switch.  
19:35:39 In "Auto."  
19:36:23 METRO: Confirm that camera light is on, on panel -  
the green light.  
19:36:45 It is now. It was on. I guess it went off.  
19:36:46 Did we get camera on the strike?  
Negative.

AIS Record 7 - Pen #5.  
19:38:02 Data on. (Master data switch on.)  
19:38:10 (AIS & DLite data on. The time code stable. Cloud  
entry .)  
19:38:15 METRO: Hit "manual" on the camera.  
Roger.  
19:38:17 (External camera in manual mode.)  
19:38:24 I just had 3 of the DLite lights go out.  
19:38:49 Getting some moderate turbulence. Still don't have  
lights back.  
19:39:09 Also, I'm not drawing tape.  
19:39:29 METRO: Turn DLite tape recorder off first, then  
instrument power off.  
19:39:38 OK. Just did it. Bring it back up?  
19:39:42 Bring instrument power on, then tape recorder on.  
19:39:49 I did it, and I still only have crate 4.  
19:39:55 It happened just after I flipped the camera to manual  
mode.  
19:40:23 METRO: Are you drawing tape now in DLite?  
Green light is on, but the tape is not going thru.  
(More switching of power - to try to get system back  
on.)  
19:42:36 (AIS & DLite data off. Cloud exit. )

AIS Record 8 - Data burst.

AIS Record 9 - Pen #6.

19:49:28 Data on. (Master data switch on.)  
19:49:35 Stormscope is clear.  
19:49:40 (AIS & DLite data on. Time code stable. Cloud entry.)  
19:49:49 (Reset stormscope range from 40 to 200 n.miles.)  
19:50:11 I think this is Pen 6.  
19:50:16 MARS tape just went off.  
19:50:36 Getting some slight turbulence.  
19:50:47 Good updraft.  
19:50:56 (Green lights out and counter not running.)  
19:51:02 Recycled, came on and went out again.  
19:51:36 If we get a strike, would we have the data?  
19:51:43 METRO Not the way it is now.

19:51:47 I tell you what, this is awful unproductive. I have  
5,000 lbs of gas, about \$500 worth. Want to bring it  
back, or stay out here and waste the rest of it?  
19:52:24 METRO: RTB. (Cloud exit.)  
19:53:22 (Two sets of DLite calcs.)  
19:53:42 36 miles to home.  
19:54:44 (AIS & DLite data off.)

AIS Record 10 - Landing.

20:03:20 (AIS data on.)  
(Landing.)  
20:06:27 (AIS data off.)

AIS Record 11 - Chocks.

20:09:50 (AIS data on.)  
21:11:48 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-049 F-106B

Date August 23, 1984

Crew Neely/Rondeau

Engine Start 18:42:XX

Take-off 18:59:53

Landing 20:06:10

Lightning Systems:

Dlite 1 Trigger\*

40ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

5ns LeCroy IV.1 TP100 2 TP101 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{I}_T=X$

\* Tape recorder failed in flight.

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 NI

C-Band Beacon OK

Airborne Radar Video OK

Voice OK - Poor quality

Kavouris Radar

Receiver NI

Aft movie camera NU

Cockpit cameras NU

Stereo Fwd NI

Hass aft NI

Aft video 1 Strike

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type GT/EP. Damage on tip

Passive protection OK

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Dam Neck, VA

Pens 6

Strikes 1

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 049

## Ground-Based

Metro

## Telemetry

Strip Charts \_\_\_\_\_ OK \_\_\_\_\_

PCM Data \_\_\_\_\_ OK \_\_\_\_\_

## Kavouris System

Basic Display \_\_\_\_\_ OK \_\_\_\_\_

INS Overlay \_\_\_\_\_ OK \_\_\_\_\_

Triggers \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Satellite Pictures \_\_\_\_\_ OK \_\_\_\_\_

Wallops

SPANDAR \_\_\_\_\_ OK \_\_\_\_\_

Videotape \_\_\_\_\_ OK \_\_\_\_\_

Digital dBZ Tape \_\_\_\_\_ OK \_\_\_\_\_

LDAR \_\_\_\_\_ PINOP \_\_\_\_\_

UHF Radar \_\_\_\_\_ OK \_\_\_\_\_

C-Band Tracking \_\_\_\_\_ OK \_\_\_\_\_

Goddard Antennas \_\_\_\_\_ OK \_\_\_\_\_

GSFC \_\_\_\_\_ NU \_\_\_\_\_

WFF \_\_\_\_\_ OK \_\_\_\_\_

LaRC \_\_\_\_\_ INOP \_\_\_\_\_

ELF Antenna \_\_\_\_\_ OK \_\_\_\_\_

LLP \_\_\_\_\_ OK \_\_\_\_\_

WFF Plots \_\_\_\_\_ OK \_\_\_\_\_

LaRC Plots \_\_\_\_\_ OK \_\_\_\_\_

WFF Tape \_\_\_\_\_ OK \_\_\_\_\_

Debrief Notes for Flight 84-050, August 30, 1984

Storm Flight/Lexington, VA

Neely/Fisher

GMT

21:53:25 (Engine start.)  
21:55:00 (DLite master power on.)

AIS record 2 - Takeoff.

22:03:40 (AIS data, radar video recorder and cockpit video camera on.)  
22:04:20 (Takeoff.)  
22:04:52 (AIS data, radar video recorder and cockpit video camera off.)

22:17:13 (DLite instrumentation on.)  
22:18:20 (2 sets of DLite calcs without tape.)

AIS record 3 - Penetration #1-9.

22:26:40 (AIS and DLite data on.)  
22:27:43 (Penetration #1, FL350, 290°.)  
22:27:45 (Voice recorder, cockpit video camera and radar video recorder on.)  
22:27:45 (DLite LeCroy crates 1-4 triggers. External camera triggers automatically. Cockpit video camera records a strike.)  
22:27:46 (External camera triggers automatically.)  
22:27:48 Direct strike to aircraft. 4 triggers.  
22:28:01 Came from lower right. Snaked up there towards the nose. Looked like it came from the aft to the front, as opposed to front to aft.  
22:28:15 Nearby flash on the left side.  
22:28:16 We are rearmed.  
22:28:34 165 n. mi. out.  
22:30:08 176 n. mi. out.  
22:32:13 Nearby flash.  
22:32:21 METRO: Field mills saturated. (Event to end Penetration #1. Begin Penetration #2.)  
22:32:26 Just evented the records for Penetration #2. Light rain and moderate turbulence.  
22:32:30 Nearby flashes all around.  
22:32:37 Climbing to FL370.  
22:32:39 Nearby flash.  
22:32:50 Very close flashes and crackle in headset.  
22:32:55 Getting very green up here.  
22:32:55.9 (DLite LeCroy crates 1-4 trigger and external camera triggers automatically. Cockpit video camera records a strike.)  
22:32:57 Direct strike to aircraft. 4 triggers.  
22:32:59 (External camera triggers automatically. Cockpit video camera records a strike.)

22:33:00 Another one (Pilot). (External camera triggers automatically.)  
22:33:02 Very close, could have been another strike.  
22:33:05 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:33:06 That's very close, too.  
METRO: We show 3 in a row.  
22:33:47 In light rain and moderate turbulence at that time.  
22:33:53 I don't know how much of that is rain and how much is ice balls.  
22:34:42 153 n. mi. from home.  
22:35:43 Event the records. (Event to end Penetration #2. Begin Penetration #3, FL370, 170°.)  
22:37:00 (Metro transmits Kavouri's picture.)  
22:37:40 In calm and dry conditions. Obscured by clouds.  
22:39:50 Turning to heading 360°.  
22:41:30 Levelled off at 35,000 ft. heading due north. We see small cell of green and yellow about 20 miles dead ahead.  
22:41:42 (Event to end Penetration #3. Begin Penetration #4, FL350, North.)  
22:41:58 In light turbulence and negligible rain at this time.  
22:42:53 Nearby flash on left side.  
22:43:04 Nearby flash ahead.  
22:43:12 Light rain beginning and light turbulence as we enter the contour.  
22:43:20 METRO: Good field mills.  
22:43:24 Nearby flashes.  
22:43:26 Light rain, light turbulence, occasional moderate turbulence.  
22:43:32 (External camera triggers automatically.)  
22:43:32.7 (DLite LeCroy crates 1-4 trigger. Cockpit video camera records a strike.)  
22:43:33 Direct strike, 4 triggers.  
22:43:37 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:43:38 Another direct strike.  
22:43:45 Nearby flashes ahead.  
22:43:47 Moderate turbulence.  
22:43:48 Light rain.  
22:44:02 Turbulence off to light.  
22:44:04 Rain, continuous light.  
22:44:07 Nearby flash ahead.  
22:44:43 A bump of moderate turbulence, still light rain.  
22:44:49 Continuous moderate turbulence and light rain.  
22:44:55 (External camera triggers automatically.)  
22:44:56 Nearby flashes.  
22:45:02 Almost 2000 ft/min. climb rate through here.  
22:48:21 (Event to end Penetration #4. Begin Penetration #5, FL350, South.)  
22:48:34 Event for penetration #5, FL350, heading 170°.  
22:48:44 We show a large area of green ahead between 15 and 20 n. mi.  
This has got to be the storm of interest.  
22:49:34 In continuous light turbulence, negligible rain.  
22:49:53 Nearby flash.  
22:50:04 Moderate turbulence, light rain.  
22:50:08 Off to light turbulence.  
22:50:10 Nearby flashes.  
22:50:15 Turning green again.  
22:50:25 Nearby flash.



22:50:27 Light to moderate rain, light to moderate turbulence.  
22:50:29 Very close flashes ahead. (External camera triggers automatically.)  
22:50:38 Nearby flashes, moderate turbulence, light rain.  
22:50:45 Very close flashes ahead. (External camera triggers automatically.)  
22:50:51 Very close flashes ahead. (External camera triggers automatically.)  
22:50:53 2000 ft/min. updraft.  
22:50:55 Light rain.  
22:51:01 Close flashes ahead.  
22:51:31 Turning left to intercept green cell 20° left of course.  
22:52:11 150 miles out.  
22:52:31 Now have small cell ahead on a heading of 120°, 10 n. mi.  
22:52:48 (Event to end Penetration #5. Begin Penetration #6.)  
22:53:08 Evented records to make this penetration #6. FL370, heading 110°.  
22:53:17 Nearby flash.  
22:53:19 Nearby flash.  
22:53:24 As we enter the contour we go to light to moderate turbulence and light rain.  
22:53:29 Very close flashes. (External camera triggers automatically.)  
22:53:31 Moderate rain, moderate turbulence.  
22:53:34.3 (DLite LeCroy crates 1-4 trigger and external camera triggers automatically. Cockpit video records a strike.)  
22:53:35 Very close flashes. Cloud to ground ahead.  
22:53:38 And we got a trigger with that.  
22:53:39 Yeah, it was very small.  
22:53:41 Did you see a strike?  
22:53:42 Yeah, on the nose.  
22:53:43 Pilot confirms a strike to the nose boom.  
22:54:25 The one I saw, a little bitty jobby-do, up to left side of major part of nose of airplane.  
22:56:03 Calm, dry, but dark.  
22:56:53 (Event to end Penetration #6. Begin Penetration #7.)  
22:57:26 Evented the record for penetration #7, FL370, heading 290°. We see an area of green and yellow ahead between 10 and 20 miles.  
22:57:55 Moderate turbulence, nearby flash, no rain.  
22:58:15 Getting dark.  
22:58:17 Light rain, moderate turbulence.  
22:58:20 Getting very dark.  
22:58:31 Lots of nearby flashes.  
22:58:33 Excellent bump - moderate turbulence, still light rain.  
22:58:37 Continuous moderate turbulence.  
22:58:40 Very close flash ahead. No triggers. (External camera triggers automatically.)  
22:58:43 Close flash ahead. (Cockpit video camera records a strike.)  
22:58:44 Strike.  
22:58:45 Very close - must have been a strike. Four triggers. (DLite LeCroy crates 1-4 trigger and external camera triggers automatically. DLite data show a strike.)  
22:58:51 Pilot confirms a strike.  
22:58:52 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:58:53 May have taken another one.

22:58:54 (External camera triggers automatically.)  
22:58:55 Big burst ahead, not a strike. (External camera triggers automatically.)  
22:58:58 (External camera triggers automatically.)  
22:58:59 Another burst of light, and another and another.  
22:59:00 (External camera triggers automatically.)  
22:59:01 (External camera triggers automatically.)  
22:59:04 Another burst of light. (External camera triggers automatically.)  
22:59:04.8 (DLite LeCroy crates 1-4 trigger. Cockpit video camera records a strike.)  
22:59:05 Big strike to aircraft, with triggers.  
22:59:08 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:59:09 Another strike. (External camera triggers automatically. Cockpit video camera records a strike.)  
22:59:10 Another strike.  
22:59:13 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:59:14 Two strikes in succession. (External camera triggers automatically, Cockpit video camera records the second strike.)  
22:59:23.2 (DLite LeCroy crates 1-4 trigger and external camera triggers automatically. Cockpit video camera records a strike.)  
22:59:26 Multiple flashes ahead of aircraft.  
22:59:28 More flashes ahead of aircraft.  
22:59:30 Continuous moderate turbulence.  
22:59:32 Now going into moderate rain.  
22:59:37 Extremely heavy rain.  
22:59:39 Heavy rain, nearby flash.  
22:59:40 (External camera triggers automatically. Cockpit video camera records a strike.)  
22:59:44 Could have been a strike there. I saw a distinct channel, but not sure it hit us.  
23:00:14 Some of those strikes were good-sized strikes.  
23:00:17 We had one that I felt the shock (physical, not electrical). The only one I felt all day.  
23:00:29 The first one in that sequence had a big "pop."  
23:01:00 (Comments by pilot on discrepancies in airspeed system.)  
23:01:22 Elapsed time on elapsed time counter is 39 min. Data has not been shut off, never had cloud exit.  
23:03:38 (Event to end Penetration #7. Begin Penetration #8, FL350, 150°.)  
23:04:16 It's getting green again.  
23:04:21 Nearby flashes as we enter the contour.  
23:04:25 Light turbulence, negligible rain.  
23:04:31 Direct strike. No triggers. (Cockpit video camera records a strike.)  
23:04:32 (External camera triggers automatically.)  
23:04:35 Light rain, light turbulence at the time.  
23:04:39 Direct strike. No triggers. (Cockpit video camera records a strike. External camera triggers automatically.)  
23:04:42 Same conditions.  
23:04:43 (External camera triggers automatically.)

23:04:43.6 (DLite LeCroy crates 1-4 trigger and external camera triggers automatically. Cockpit video camera records a strike.)  
23:04:44 Lots of flashes up front. (Pilots call strike.)  
  
23:04:46 Now we get triggers.  
23:04:49 Nearby flashes ahead.  
23:04:52 Good strike. Left side. (Cockpit video camera records a strike  
External camera triggers automatically.)  
23:04:53 (External camera triggers automatically.)  
23:04:59 Nearby flashes.  
23:05:01 (External camera triggers automatically.)  
23:05:02 Moderate turbulence, light rain  
23:05:06 Lots of flashing ahead. (External camera triggers automatically.)  
23:05:10 More flashing ahead.  
23:05:11 More flashing  
23:05:12 More flashing.  
23:05:16 Moderate turbulence, light rain.  
23:05:24 Almost continuous flashing  
23:05:26.2 (DLite LeCroy crates 1-4 trigger and external camera triggers  
automatically. Cockpit video camera records a strike.)  
23:05:27 Another strike, I think. (External camera triggers automatically.)  
23:05:32 There we go! (External camera triggers automatically. Cock-  
pit video camera records a strike.)  
23:05:33 (External camera triggers automatically.)  
23:05:34 A direct strike - confirmed.  
23:05:44 Moderate turbulence, light to moderate rain.  
23:05:49.5 (DLite LeCroy crates 1-4 trigger and external camera triggers  
automatically. Cockpit video sees bright frames only but  
DLite data show a strike.)  
  
23:05:50 Very close flashes ahead, and we get triggers with that.  
23:05:57 There's a direct strike - left side. (External camera triggers auto-  
matically. Cockpit video camera records a strike.)  
23:05:58 (External camera triggers automatically.)  
23:06:02 That was a good bright one.  
23:06:04 There's another from right side. (External camera triggers  
automatically. Cockpit video camera records a strike.)  
23:06:07 And radar blinked  
23:06:14 What I got on the radar was a continuous band of green at 15 n.mi.  
range 3 miles wide from left side to center for one sweep, and  
it went away.  
  
23:06:43 We think we took about 9 strikes in penetration #8.  
23:07:33 245° @ 60 n.mi. from Gordonsville.  
23:08:14 Bump of heavy turbulence, light rain.  
23:08:24 (Event to end Penetration #8. Begin Penetration #9, FL370.)  
23:08:28.4 (External camera triggers automatically and DLite LeCroy  
crates 1-4 trigger. Cockpit video camera records a strike.)  
23:08:29 Nearby flashes ahead.  
23:08:31 Rain. Moderate to heavy turbulence.  
23:08:35 METRO: We show triggers.  
23:08:36 I confirm that, but didn't see the channel. Did see a flash.  
23:08:40 More flashes.  
23:08:47 More flashes.  
23:13:41 (AIS and DLite data off.)

AIS record 4 - DLite cals.

23:14:10 (AIS and DLite data on.)  
(Two sets of cals.)  
23:15:32 (AIS and DLite data off.)  
  
23:16:56 (Voice recorder off.)  
(Run off DLite tapes with AIS off.)  
23:23:20 (DLite tapes out.)  
23:23:44 (DLite instrumentation off.)

AIS record 5 - Landing.

23:23:30 (AIS data on.)  
23:33:07 (Landing.)  
23:33:48 (AIS data off.)  
  
23:34:02 (DLite master power off.)  
23:36:20 (Radar video recorder and cockpit video camera off.)

AIS record 6 - chocks.

23:36:50 (AIS data on.)  
23:37:36 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-050 F-106B

Date August 30, 1984

Crew Neely/Fisher

Engine Start 21:53:25

Take-off 22:04:20

Landing 23:33:07

Lightning Systems:

Dlite 11 Triggers

40ns LeCroy I.1  $\dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{D}_{W,R}$  2  $\dot{D}_{W,L}$  3  $\dot{D}_F$

5ns LeCroy IV.1 TP100<sup>2</sup> INOP 3 TP123

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{I}_T=X$

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 INOP

C-Band Beacon OK

Airborne Radar Video OK

Voice INOP

Kavouris Radar

Receiver OK

Aft movie camera NG. Iced lens

Cockpit cameras

Stereo Fwd NI

Hass aft NI

Aft video OK. 25 Strikes.

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type G/EP. Some damage

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Lexington, VA

Pens 9

Strikes 27

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 050

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR INOPVideotape NUDigital dBZ Tape NULDAR NU- Too farUHF Radar OKC-Band Tracking OKGoddard Antennas NUGSFC NUWFF NULaRC NUELF Antenna OKLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-051, September 13, 1984

Storm Flight/Roanoke Rapids NC to Coefield NC

Brown/Winebarger

GMT

AIS Record 1 - Cockpit Video Check.

17:37:00 (AIS data on.)  
17:37:16 (AIS data off.)  
17:43:50 Engine start.

AIS Record 2 - Takeoff.

17:53:50 (AIS data on.)  
17:54:46 (Liftoff.)  
17:55:36 (AIS data off.)

AIS Record 3 - Penetration #1.

18:07:00 (Data on.)  
18:07:01 Data is on. Entering the cloud, heading 240°, altitude 24,000.  
18:07:18 In turbulence.  
18:07:20 Light rain, moderate turbulence.  
18:07:46 (Event - storm exit.)  
18:07:50 We're out.  
18:07:52 (Data off.)

AIS Record 4 - Penetration #2.

18:10:00 (Data on.)  
18:10:08 Back in. Data is on for penetration 2.  
Heading 320°, altitude 24,000.  
18:10:30 Looking -2° now.  
18:10:37 Light precipitation, light turbulence.  
18:10:49 METRO: Seeing any nearbys?  
18:10:51 Seeing nothing.  
18:10:54 There was a flash.  
18:11:30 Metro, the field mills fell off flat.  
18:13:13 METRO: Still in the clouds?  
18:13:15 Affirmative.  
18:13:17 METRO: Keeping data on?  
18:13:19 Affirmative.  
18:13:54 (Data off - still in clouds.)

AIS Record 5 - Penetration #3.

18:14:20 (Data on - in clouds.)  
18:15:20 METRO: Have you started third penetration?  
We see field mill activity.  
18:15:25 We are in 3rd penetration.

18:15:45 We are on the north-west side of these cells heading 130°, have to look -10 to see them.  
18:16:07 Little light turbulence now.  
18:16:16 Very light precipitation.  
18:16:22 Updraft.  
18:16:53 (Event - storm exit.) We're out. Couple of pretty good bumps just as we exited.  
18:16:58 (Data off.)  
18:17:20 METRO: Maybe you ought to drop altitude, Try 20,000.

## AIS Record 6 - Penetration #4.

18:20:10 (Data on.)  
18:20:11 Data on for penetration 4, altitude 20,000, heading 325° and we just entered.  
18:20:16 (Event - storm entry.)  
18:20:28 Light turbulence. Very light precipitation.  
18:20:50 A little more bumpiness down here, than we had up high.  
18:21:26 We're out - just about. Start 90° - 270°.  
18:21:27 (Event - storm exit.)  
18:21:41 (Data off.)

## AIS Record 7 - Penetration #5.

18:23:50 (Data on - in cloud.)  
18:24:34 Return seems to have grown. Have some yellow now. -3° tilt.  
18:25:33 Little light precipitation and light turbulence.  
18:26:01 (Event - storm exit.)  
18:26:03 (Data off.)

## AIS Record 8 - Penetration #6.

18:30:30 (Data on.)  
18:30:36 (Event - storm entry.)  
18:30:45 Data is on for penetration 6. We are in first cloud.  
18:31:34 Some rain.  
18:31:47 (Event 1st cell exit.)  
18:31:50 We broke out of first one. Turning to 150° heading, at 20,000 ft.  
18:32:00 We can see the tops of these clouds. Looks like they may go up to about 23 or 24. No anvils, just cumulus sort of top on it that is smaller than the cloud from below the top.  
18:32:05 (Event - cloud entry.)  
18:32:22 (Event - cloud exit.)  
18:32:45 (Event - cloud entry.)  
18:32:50 Getting some heavier precipitation. It is still light.  
18:33:11 Back in another one. Little more rain and that was a pretty good bump.  
18:33:20 (Event - exit.)  
18:33:33 (Event - entry.)  
18:34:00 (Event - exit.)  
18:34:03 (Data off.)



## AIS Record 9 - Penetration #7.

18:36:30 (Data on.)  
18:36:45 (Event cloud entry.)  
18:37:30 Data is on penetration 7.  
18:37:34 METRO: Got some interesting field mills - no high frequency  
component but some excursions.  
18:39:16 (Data off and cloud exit.)

## AIS Record 10 - Penetration #8.

18:42:00 (Data on - in cloud.)  
18:42:50 (Data off - in cloud.)

## AIS Record 11 - Penetration #9.

18:45:14 (Event - storm entry.)  
18:45:20 (Data on.)  
18:45:29 Updraft.  
18:46:14 Headed 300°, now at 20,000. Penetration 9.  
18:46:48 We are breaking in and out of clouds through here.  
18:47:32 Getting some light precipitation and light turbulence.  
18:47:39 Pop out.  
18:48:10 Back in next cloud anyway.  
18:48:28 Little wing rock. Pretty good bounce.  
18:48:32 Distant flash.  
18:48:40 Out.  
18:48:47 (Data off.)

## AIS Record 12 - Penetration #10.

18:51:40 (Data on.) Data is on for penetration 10, altitude 20,000,  
heading 125°.  
18:51:54 (Event - cell entry.)  
18:51:59 In the first cell.  
18:52:02 Some precipitation and moderate turbulence.  
18:52:08 Moderate precipitation now.  
18:52:15 (Event - cell exit.)  
18:52:16 Breakout of that one.  
18:53:06 (Event - cell entry.)  
18:53:07 Back in the next one.  
18:53:16 Updraft.  
18:53:18 METRO: Lot of field mill going on here.  
18:53:32 Getting moderate precipitation for a brief instant.  
18:53:47 (Event - cell exit.)  
18:53:48 Another breakout.  
18:54:40 (Event - cell entry.)  
18:54:42 Back in another one. Pretty good wing rock and light  
precipitation.  
18:54:57 (Event - cell exit.)  
18:54:59 Out of that one.  
18:55:05 (Data off.)

## AIS Record 13 - Penetration #11.

18:57:35 (Event - cell entry.)  
18:57:40 (Data on.) We are in penetration 11, we're in the clouds,  
heading 310°, altitude 19-6.  
18:58:16 Getting some moderate precipitation and light turbulence.  
18:58:35 (Event - cell exit.)  
18:58:37 Broke out of that one.  
18:58:58 (Event - cell entry.)  
18:59:38 Getting a few bumps along, occasional light precipitation.  
18:59:52 METRO: Good field mills.  
19:00:02 METRO: What was going on when I called good field mills?  
19:00:04 Nothing.  
19:00:06 (Event - cell exit.)  
19:01:00 (Event - cell entry.)  
19:01:02 Back in again.  
19:01:09 Light precipitation, light turbulence.  
19:01:29 (Event - cell exit.)  
19:01:33 (Data off.)

## AIS Record 14 - Penetration #12.

19:04:10 (Data on.)  
19:04:20 (Event - cloud entry.)  
19:04:24 Back in first cell for penetration 12, heading 100°, altitude  
20,000.  
19:04:59 (Event - cloud exit.)  
19:05:03 Nothing in that one. We are out between them now.  
19:05:40 (Event - storm entry.)  
19:05:50 We are back in.  
19:05:58 Pretty good jolt there.  
19:06:02 Couple pretty good bumps and light precipitation.  
19:06:07.7 (All LeCroys triggered, aft camera and cockpit video camera  
recorded a strike.)  
19:06:08 Good strike!  
19:06:09 We got a good strike then with triggers.  
19:06:12 Moderately loud with a little bit of a thump.  
19:06:16 Looked like to me it was pretty symmetric on the base of the nose  
probe.  
19:06:47 That was in pretty smooth clouds. Nothing going on particularly.  
19:06:53 Some light turbulence just about all.  
19:06:56 Light, occasional.  
19:07:00 (Event - storm exit.)  
19:07:11 A nice definite strike with the noise being moderately loud as it  
was. Kinda woke me up.  
19:07:22 Thinking about the fact I hadn't had my lunch yet and how nice it  
would be to start munching on that.  
19:07:23 (Data off.)

## AIS Record 15 - Penetration #13.

19:08:13 (Data on - in clouds.)  
19:09:38 Light to moderate turbulence.  
19:09:47 METRO: Got field mills going here.  
19:09:49 Precipitation only now and then.

19:09:54 In penetration 13.  
19:10:12 Getting some light precipitation and light turbulence.  
19:10:33 (Event - storm exit.)  
19:10:37 Broke out of that cell.  
19:11:02 (Data off.)

AIS Record 16 - Penetration #14 and DLite Cals.

19:11:50 (Data on - in cloud.)  
19:13:38 In penetration 14, heading 105°, altitude 20,000.  
19:13:45 We're in the cell.  
19:13:52 Light precipitation, light turbulence.  
19:15:30 Getting light precipitation and light turbulence again.  
19:16:47 (Event - storm exit.)  
19:16:53 DLite cal now.  
19:17:40 (Data off.)

AIS Record 17 - Landing.

19:23:10 ( AIS data on.)  
19:25:01 (Touchdown.)  
19:25:49 (AIS data off.)

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-051 F-106B

Date Sept. 13, 1984

Crew Brown/Winebarger

Engine Start 17:43:50

Take-off 17:54:46

Landing 19:25:00

Lightning Systems:

Dlite 1 Trigger

40ns LeCroy I.1 I<sub>D</sub>F 2 I<sub>N</sub> 3 I<sub>T</sub>

10ns LeCroy II.1 I<sub>D</sub>T 2 I 3 B<sub>L</sub>

10ns LeCroy III.1 I<sub>D</sub>W,R 2 I<sub>D</sub>W,L 3 I<sub>D</sub>F

5ns LeCroy IV.1 TP114 2 TP116 3 TP125

Digital Peak Counter 1 I=X 2 I<sub>T</sub> NG

Non-Lightning Systems:

AIS No Vanes

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 1 Strike. Auto. 400 pps.

Cockpit cameras

Stereo Fwd NI

Mass aft NI

Aft video 1 Strike

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type GT/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region Roanoke Rapids,

Coefield, NC

Pens 14

Strikes 1

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

FLIGHT #84- 051

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay PINOPTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR OKVideotape OKDigital dBZ Tape OKLDAR INOPUHF Radar OKC-Band Tracking NUGoddard Antennas NU - Too farGSFC WFF LaRC ELF Antenna OKLLP OKWFF Plots OKLaRC Plots OKWFF Tape OK

Debrief Notes for Flight 84-052, October 18, 1984

Storm Flight/W122 Charlie-Foxtrot

Brown/Winebarger

GMT

12:12:40 Engine start.

AIS Record 1 - Takeoff.

12:22:40 (AIS data on.)

12:23:41 (Liftoff.)

12:25:10 (AIS data off.)

AIS Record 2 - Field Mill Check.

12:40:20 (Data on.)

12:41:10 (Data off.)

AIS Record 3 - Penetration 1 & 2.

12:49:24 Gonna bring data on.

12:49:40 (Data on.)

12:49:44 (Storm entry.)

12:49:50 Just entered the cloud, heading 196°, altitude 31.

12:50:02 METRO: We have some field mill activity.

12:50:13 Getting light turbulence.

12:50:19 Light precip.

12:50:24 Momentary light rain.

12:50:25 (Storm exit.)

12:50:30 Breakout.

12:51:24 METRO: We see level 4 ahead of you about 10 miles.

12:51:28 That's where we're going.

12:51:55 A lot of stormscope activity on this one.

12:52:00 A lot more vertical development than the other one.

Penetration 2.

12:52:04 (Storm entry.)

12:52:07 We are in the second one.

12:52:22 Light turbulence, light precip.

12:52:57 Moderate turbulence and I think we are about to break out.

12:53:00 (Storm exit.)

12:53:20 (Data off.)

12:53:53 That was one penetration with 2 cells.

12:54:24 Let's change that and make it 2 since it was totally separated by clear air.

12:54:56 In 90°-270°, altitude is 31,000.

## AIS Record 4 - Penetration 3.

12:56:10 (Data on.)  
12:56:15 Heading north, dropping to 29,0 for penetration 3.  
12:56:47 (Storm entry.)  
12:56:48 In storm getting little moderate turbulence, light precip.  
12:57:16 Lots of flashes.  
12:57:39 More rain now and distant flashes.  
12:57:44 (Storm exit.)  
12:57:46 Breakout.  
12:57:58 (Data off.)  
12:58:17 We got several Hasselblads inside that cell, both trips.  
12:59:26 In 90°-270° to the south to repenetrate the cell.  
It's the electrically active one so we are sticking with that.  
13:00:30 I saw a flash. That's encouraging.  
13:00:40 -5° on tilt.

## AIS Record 5 - Penetration 4.

13:01:20 (Data on.)  
13:03:32 (Storm entry.)  
13:01:36 In the storm again, light turbulence, altitude 29,000,  
heading 190°.  
13:01:47 Getting light rain.  
13:01:48 Lots of flashes.  
13:01:52 Updraft.  
13:01:54.5 (All LeCroys triggered, Aft camera , cockpit and two  
Hasselblads recorded the strike. )  
13:01:55 Good strike! Nose! Hot dog.  
13:01:58 Got a good strike there. I saw it on the left wing tip.  
13:02:00 I saw it on the nose.  
13:02:04 Hope to hell we got a trigger.  
13:02:05 We did.  
13:02:14 We got a Hasselblad trigger with that one.  
13:02:22.7 (All LeCroy's triggered - strike.)  
13:02:54 That was a good one too.  
13:02:56 Sure was.  
13:03:00 (Storm exit.)  
13:03:08 (Data off.)  
13:04:15 Light turbulence and precip at time.  
13:04:20 Had experienced an updraft maybe 10 to 15, maybe 10 before,  
seconds before.  
13:04:31 And I could hear it. It was sorta medium to low medium  
noise.  
I'd say maybe medium.  
13:04:44 A nice bright channel up here on the nose.  
13:05:09 We're coming thru 40°, back to north to make penetration.

## AIS Record 6 - Penetration 5.

13:06:25 Data is on for penetration 5.

13:06:30 (Data on..) (Storm entry.)  
13:06:31 Just entered the storm, heading 250°, altitude 29,000.  
13:06:42 -5° on tilt.  
13:07:00 Real light precip.  
13:07:06 Very light turbulence.  
13:07:47 Updraft.  
13:07:56 Was that a strike, Rog? (Visible on Video.)  
13:07:59 I didn't see anything.  
13:08:02 (Hasselblad triggered.)  
13:08:08 (Storm exit.)  
13:08:18 (Data off.)  
13:08:32 Data is off, out in clear, making 90°-270° to penetration 6.  
13:09:30 (Comments about stormscope-trying to decide where to fly.)  
13:09:53 Looking down 5° and don't have anything.  
5.8 fuel.

## AIS Record 7 - Penetration 6.

13:12:19 Data on for penetration 6, entering the cloud, heading south, altitude 30,000.  
13:12:20 (Data on.)  
13:12:26 (Storm entry.)  
13:12:40 Light turbulence.  
13:12:48 Flashes.  
13:12:50 Light turbulence.  
13:12:56 Light rain now.  
13:13:01 Updraft.  
13:13:30 (Storm exit.) Getting an unique water shedding, left and right off center bar of windscreen. It's forming a stream here and here, see it, Rog?  
13:13:38 Yeah.  
13:13:39 Heading 172°, had a distant flash.  
Wasn't too distant, triggered Hasselblad.  
13:13:48 Also getting fogged up windscreen in here, on right side.  
It's on inside. Uh .....problem.  
13:14:37 Out in the clear.  
13:14:39 (Data off.)  
13:18:00 5.5 fuel.

## AIS Record 8 - Penetration 7.

13:18:09 (Storm entry.)  
13:18:10 345°, FL 300.  
13:18:20 (Data on.)  
13:18:30 We are in penetration 7. We are in the clouds.  
13:18:52 (Comments about Hasselblad - Fogging frames-triggering-bright in cockpit and triggering.)  
13:19:22 Smooth cloud, some little light turbulence now.  
13:19:30 Don't have any precip and don't see any flashes either.  
13:19:54 Darker, getting some rain, light to moderate rain. This shedding pattern is very different, for some reason, from what I've seen before.



13:20:10 Lots of flashes then.  
13:20:13 METRO: Excellent field mills and Hasselblad now.  
13:20:17 Breakout. (Storm exit.)  
13:20:45 (Data off.)  
13:22:26 Hey! You see that one?  
13:22:28 I saw that.

## AIS Record 9 - Penetration 8.

13:22:47 (Storm entry - 1st cell.)  
13:22:50 (Data on.)  
13:23:04 We are going thru a little cell in our turn here. It has  
got light turbulence.  
13:24:00 (1st cell exit.)  
13:25:00 (2nd cell entry.)  
13:25:13 We are back in main storm. Altitude 29,000, on 160° and  
turning right a little more.  
13:25:27 Light rain.  
13:25:30 Penetration 8.  
13:25:39 Light turbulence, real light rain.  
13:25:51 Continued light rain and turbulence.  
13:26:18 Distant flash.  
13:26:56 (Storm exit.)  
13:27:29 Leaving data on. In light cloud, just outside the storm.  
(Make note to Zaepfel.)  
13:28:34 (Data off.)  
13:28:40 Headed north now for penetration 9.

## AIS Record 10 - Penetration 9.

13:29:19 (Storm entry.)  
13:29:20 (Data on.)  
13:29:33 In the storm, heading north, 29,000.  
13:29:50 5.1 fuel.  
13:30:02 Light precip.  
13:30:13 (Storm exit.)  
13:31:00 About 4.7 on fuel.  
13:31:25 Data on for Pete Zaepfel's. Thin clouds.  
13:31:50 (Data off.)

## AID Record 11 - Dlite Cals.

13:34:50 (Data on.)  
13:36:10 (Data off.)

## AIS Record 12 - Burst.

## AIS Record 13 - Landing

14:15:10 (AIS data on.)

Flight 84-052

5

14:16:57 (Touchdown.)  
14:17:42 (AIS data off.)

AIS Record 14 - Chocks.

14:31:40 (AIS data on.)  
14:31:46 (AIS data off.)

# STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984

Flight # 84-052 F-106B

Engine Start 12:12:40

Date Oct. 18, 1984

Take-off 12:23:41

Crew Brown/Winebarger

Landing 14:16:57

## Lightning Systems:

Dlite 2 Triggers

10ns LeCroy I.1  $\int \dot{D}_F$  2  $\dot{I}_N$  3  $\dot{I}_T$

10ns LeCroy II.1  $\dot{D}_T$  2  $\dot{I}$  3  $\dot{B}_L$

10ns LeCroy III.1  $\dot{B}_{W,R}$  2  $\dot{B}_{W,L}$  3  $\dot{D}_F$

10ns LeCroy IV.1 TP114 2 TP116 3 TP125

Digital Peak Counter 1  $\dot{I}=X$  2  $\dot{I}_T$  NG

## Non-Lightning Systems:

AIS OK

INS OK

Telemetry:Top OK

Bottom OK

Airborne Radar: Fwd OK

Aft OK 0-5 OK

C-Band Beacon OK

Airborne Radar Video OK

Voice OK

Kavouris Radar

Receiver OK

Aft movie camera 1 Strike. Auto. 400 pps.

Cockpit cameras

Stereo Fwd 1 Strike

Hass aft 1 Strike

Aft video 1 Strike

Field Mills (4) OK

X-Ray TBD

Los Top TBD Aft TBD

Fin Cap Type G/EP

Passive protection

Diverter strips OK

Wire mesh OK

Stormscope Aft OK 0.5 OK

Region W-122F

Pens 9

Strikes 2

Nearbys 0

STORM HAZARDS DATA CONFIGURATION SUMMARY - 1984FLIGHT #84- 052

## Ground-Based

Metro

## Telemetry

Strip Charts OKPCM Data OK

## Kavouris System

Basic Display OKINS Overlay OKTriggers OKVideotape OKSatellite Pictures OKWallopsSPANDAR                     Videotape NUDigital dBZ Tape NULDAR NUUHF Radar NUC-Band Tracking OKGoddard Antennas NUGSFC NUWFF NULaRC NUELF Antenna NULLP OKWFF Plots OKLaRC Plots INOPWFF Tape OK